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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-Second Annual Meeting, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, PROVIDENCE, R. I., Oct. 5, 1894.

Extract from the Constitution.

Sec. 12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least 10 days prior to the meeting at which the application is acted on.

GENERAL ANNOUNCEMENT.

The 22d annual meeting of the American Gas Light Association will be held at Washington, D. C., October 17, 18 and 19, 1894.

The meeting will be called to order by the President, W. H. Pearson, of Toronto, Canada, at 10 o'clock, A.M., on October 17, in Builders' Exchange Hall, on 13th street, between G and H streets. This is 3½ blocks from the headquarters, the Arlington Hotel, which is located on the corner of H street and Vermont avenue, one block from the White House. The Arlington is conveniently reached by the principal street car lines, as are the other first-class hotels in its vicinity.

As the most satisfactory quarters are always obtained by writing in advance to the hotel people, the following list of hotels is appended, and it is particularly suggested that in writing to them a reply be requested, for which a self-addressed and stamped envelope should be inclosed, as misunderstandings and disappointments may thereby be averted. Remember, "First come, first served."

Hotel.	Rate per Day.	Distance from Hall.	Remarks.
Arlington.....	$4 to $5	3½ blocks.	This is headquarters.
Riggs House....	$3 to $5	2 "	Located at 15th and G streets.
Willard's	$3.50 to $4.50	3½ "	Located at 14th street and Penn ave.
Ebbitt House...	$4	2½ "	Located at 14th and F streets.
Wormley's.....	$3	2½ "	Located at 15th and H streets.
Normandie.....	1 in room, $4.50 2 " 3.50 3 " 3.00	4 "	Located at 15th and I streets. Can take 100 persons.
Shoreham.....	$4	2½ "	Located at 15th and H streets. Can take 125 to 150.
Hamilton House	$2.50 up	4 "	Located at 14th and K streets.
National.....	$4	10 "	Located at Penna. av. and 6th st. Cars go within 3 blocks of hall.
Metropolitan....	$2.50	10 "	Penna. ave., close to National Hotel.
Howard House.	$2.50	10 "	Penna. ave., close to National Hotel.

All of the above hotels are conducted on the American plan, and can take from 25 to 50, except the Normandie and Shoreham (see "Remarks," above). The rates named by the Arlington, Riggs, Willard's and Normandie are special for this convention.

The Ebbitt has also made reductions, viz.: Fifty rooms on 6th floor, with steam heat, reduced to $2.50 and $3.00 each person per day; fifty rooms on other floors reduced from $4.00 to $3.50. Nearly all other grades of rooms are also cut in price, so that those who wish more elaborate accommodations can obtain them at lower prices than formerly.

The roll call will be made by means of the door card method as usual, and be in charge of one of the Committee of Arrangements. Each member or visitor upon entering the hall for the first time will at the door receive a special card upon which to write his name, address, etc., the card then to be given to the doorkeeper.

The list of papers to be read at the meeting is as follows:

1. "Observations on Sundry Methods of Making Water Gas from Bituminous Coal" (Vol. XI., No. 1, page 58), with "Supplement" (Vol. XI., No. 2, page 169), by Frederic Egner.
2. "Public Ownership of Gas Properties" (Vol. XI., No. 1, page 67), by Walton Clark.
3. "A Small Experimental Plant as an Aid to the Management of a Coal Gas Works" (Vol. XI., No. 2, page 118), by Peter Young.
4. "Some Experiences with the Welsbach Incandescent Gas Lamp" (Vol. XI., No. 2, page 121), by W. S. Rathell.
5. "One of the First Meter Makers in the United States" (Vol. XI., No. 2, page 130), by H. C. Slaney.
6. "Light Wasted in Bad Flames" (Vol. XI., No. 2, page 146), by N. W. Gifford.

7. "Applications of Chemical Technology to Gas Manufacture" (Vol. XI., No. 2, page 149), by Geo. H. Harper.

8. The Use of Gas for Other Purposes than Lighting" (Vol. XI., No. 2, page 172), by Burdett Loomis.

9. "Taxation" (Vol. XI., No. 2, page 181), by Allen R. Foote (by request).

10. "Patching Holders while in Use" (Vol. XI., No. 2, page 194), by J. H. Findlay.

Also two or three others that have not yet been turned in to the Secretary.

The members are particularly requested to carefully read every page of the July and October "Quarterlies," and come to the meeting prepared to discuss the articles therein presented, as the papers will be distributed in that form only.

Each member is expected to send in not only papers on original subjects, but also written discussions or analyses of any or all of the papers written by others, such written discussions to appear in the next issue of the "Quarterly."

The Question Box will be be made a special department of the "Quarterly," provided the members will support it by sending in responses to queries, as well as to keep the Box full of questions, which will be printed in each issue with the responses to the queries of the previous issue. Send in your questions as early as possible; *now*, if you can. Questions sent in for this meeting will be found in Vol. XI., No. 2, page 196.

Application Blanks will be found among the last pages of the April and October Quarterlies.

The Committee of Arrangements are completing the details of their programme, which is expected to include the usual banquet, an excursion to Mt. Vernon, etc., and the members and their ladies have been invited to visit the Maryland Meter and Manufacturing Co., of Baltimore, on Saturday, 20th, by whom they will be hospitably received. During the meeting the comfort and amusement of the ladies will also be attended to, for full details of which consult the programme which you will receive at the meeting.

Agreeably to the ancient custom of the Association, it is proposed to hold the traditional banquet on the evening of Thursday, Oct. 18, and in continuation of the precedent established last year, each one will pay for his own ticket. Price of banquet ticket has been fixed at $5.

Have you returned to the Secretary the card sent with the circular of September 10th? This is very important, that the data therein asked for should be in his hands as soon as possible, ***whether you expect to attend the meeting or not.*** The Committee cannot complete their work without it.

During the days of the meeting bulletin boards will be placed in the lobbies of the Headquarters and the Meeting Hall. All members are warned to take due notice thereof and govern themselves accordingly, that they may be apprised of any change in or addition to the programme

Many of the members have allowed their dues to remain yet unpaid, and this is a source of much difficulty to the Treasurer and extra work and worriment to the Secretary, who has already sent several statements to each of the delinquent ones, as you must know, if you are one of them, unless you have failed to notify him of change of address.

The present addresses of the following-named members are unknown to the Secretary, who will be glad to receive any information concerning them: E. H. B. Twining, W. I Wilson, L. S. Jones and Frank Bierce.

Special Cars, etc.—The Secretary's party will go via Fall River Line on Monday evening, and join the New York party on the 11:30 A.M. Royal Blue Line train Tuesday forenoon. The party from New York will be a large one, and several special cars have been secured, affording ample and first class accommodations. If you are not booked for the party of the Secretary of the N. E. Association, by all means join this party, as a special agent of railroad companies is to accompany us to insure every comfort.

A. B. SLATER, Jr., Sec.

Extract from the Constitution.

51. No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the Proceedings.

52. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council.

Just before going to press Secretary Slater's second official announcement came to hand. It precedes "Briefly Told."

BRIEFLY TOLD.

NEXT WEEK, AT WASHINGTON.—All that we can do at the present time of writing, regarding the outlook for the meeting next week of the American Association, is to report progress, for Mr. Slater's final official announcement has not come to hand. We regret to say that he has been somewhat indisposed, and although his illness was not of a serious nature, it was nevertheless sufficiently pronounced to cause him quite some discomfort. A short spell of enforced quiet routed his enemy, and he is again to the fore with his customary briskness. We are well within bounds when stating in a general way that all the arrangements for an exceptionally interesting meeting have been completed, and can unreservedly repeat our prediction of a week ago that the convention will be remarkably well attended. The party leaving New York at 11:30 A.M. of October 16th, by way of the Royal Blue Line, will require two special cars for their transportation, and the report is that the Colonial Express party, via Boston and the Pennsylvania, is also being strongly recruited. Another matter that may with propriety be spoken of here, since it will happen as a sequel to the meeting, is the invitation extended by the proprietors of the Maryland Meter and Manufacturing Company, of Baltimore, Md., to the members of the Association to visit the Company's new and handsome factories in the Monumental City. The train service between Washington and Baltimore is frequent and fast, and there is no reason for failing to accept the Company's invitation on the score of inconvenience or expenditure of too much time. The distance can easily be made in 50 minutes, and the Maryland folks will be on hand to receive their guests from "early morn to dewy eve" on Saturday, October 20th. Luncheon will be served at half after 12 of the date noted, and outgoing trains leave Baltimore at the following times: Western express, for Pittsburgh, Columbus Cincinnati, Chicago and St. Louis, 4:20 P.M.; Boston (a through sleeper), 4:20 P.M; Philadelphia and New York, almost any time; Buffalo and Rochester express, 8:15 P.M.; Southern points, 9:20 P.M. It is needless to add that those who visit Baltimore will be royally entertained.

THE COLLAPSE OF THE OPPOSITION AT MONTREAL.—This caption is not as accurate as it might be, in that the selling out of the Consumers Gas Company to the old Montreal Company might be termed a collapse, or not, just as one was financially affected thereby. For instance, Mr. John Coates and his associates, as coparceners of the original rights obtained by Messrs. Coates & King, in their later role as proprietors of the Consumers Gas Company, will not consider their abandonment of independence as a collapse; not at all. Nor should they, for they admit that in the recompense granted them by their whilom enemy, for quitting the field of gas supply in Montreal, they have obtained money sufficient to reimburse them for every expenditure they made, with legal interest thereon, and a clear profit of 15 per cent. beside. So, we presume, from the Coates point of view, the proper way to style their disappearance is to call it an absorption and not a collapse. To put it in a rough way, the Coates syndicate claims to have spent in Montreal, "in one direction or another," nearly $600,000. Perhaps they did; but if they did they must have been remarkably lavish in unseen directions, for certainly the plant and all its belongings cannot be underwritten as worth any such sum. Taking them at their own statement, however, the price paid them by the Montreal Company is put at $400,000 worth of new stock in the latter, at par, and, as the shares of the Montreal Company are worth in open market 180 per cent., it does not require the aid of calculus to determine that the Coates syndicate easily cleared "interest and 15 per cent." upon their "investment." Possibly Mr. Coates and his associates have a way of compounding interest which is satisfactory to themselves; but in the balancing of the accounts we imagine that the proprietors of the old Montreal Company are ruefully aware how much that interest has been compounded. So ends the farce at Montreal, and again are we given an admirable illustration of what competition in the gas business really means. Mr. Coates, by the way, is unmistakably a genius, in some respects at least. Of course, genius assumes many delicate shades and takes on divers sinuous shapes; and the Coates genius in our belief is greatest in his firm conviction that all men (save himself) can be cajoled, or, in the slang of the day, "jollied" to the point of seeing as he sees, or of believing as he believes. Genius must be the starting point of faith of that nature, but it savors of the genius of the awkward bird that permits itself to be "tooled" inshore to the sportsman's gun by the flutter of a rag attached to the tail of an odd-looking dog. To prove the Coates genius, we only ask his permission to print two letters received by us from him, both of which emanated from him, and neither of which has been replied to by us, save in the sense that this may be a reply to them.

NOTES.—Mr. William J. Murray, of this city, has been awarded large contracts for main laying, by the New York and East River Gas Company, of New York, and we imagine the Company is quite well satisfied with Mr. Murray's way of doing things, for seldom has pipe placing been performed in New York with the speed displayed by Mr. Murray and his men.——The tender of the Consumers Gas Company, of Toronto, Canada, for the public lighting of that city, was made on the following basis: For exclusive lighting of the city with gas on present mains, $22 per lamp per year; on new mains, $23 per lamp; for a minimum of 1,000 lights on the present mains, $23 per lamp; on new mains, $24 per lamp; Lambeth lamps, $70 per lamp. The current contracts for gas lamps are: $24 and $25 per lamp, respectively, regard being had for the main conditions; and $75 for Lambeth lamps.

Some Water Gas Statistics.

By an "Old Contributor."

Having read the admirable paper of Mr. John Stelfox, of Belfast, on "A First Season's Experience with Carbureted Water Gas," published in one of the June numbers of the *Journal of Gas Lighting*, the writer feels moved to submit to the reading gas man a few items of results obtained from apparatus mostly under his personal observation, or received from entirely trustworthy sources, after visiting and carefully inspecting the process in operation. The figures may be useful to persons not familiar with carbureted water gas, and may be relied upon as absolutely correct so far as the particular apparatus and its special location—when the figures given were received—are concerned.

Name or Style of Apparatus.	Naphtha, Gals. Used per 1,000 Cu. Ft.	Crude Oil, Gals. Used per 1,000 Cu. Ft.	Total Oil Used per 1,000 Cu. Ft.	Pounds of Coal Used in Generators.	Candle Power of Gas Produced.	Cu. Ft. Gas Made in a Day's Work per Man at Apparatus.[2]	Kind of Fuel Used in Generators or Retorts to Make Gas.	Daily Capacity of Apparatus from which these Averages were Taken.	
Improved Lowe	4.67	.....	4.67	40.2	24.0	75,000	Anthracite.	Cu. Ft. 300,000	One month, about 12 hours per day.
Granger-Collins	4.57	.....	4.57	40.3	20.0	75,000	"	300,000	Ditto.
Springer	5.29	.....	5.29	39.9	18.4	120,000	Anthracite and coke.	1,500,000	Average for year.
Pratt & Ryan	4.89	.....	4.89	42.6	19.0	120 000	"	1,250,000	Whole year.
Egner	0.75	3.51	4.26	30.9	20.8	87,585	Gas coke.	300,000	One year.
Flannery	5.00	.....	5.00	42.9	26.0	80,000	Anthracite.	2,400,000	Full time.
Rose[1]	4.18	.....	4.18	91.5	24.0	Not known.	Gas Coal.	150,000	Experimentally.
Loomis	4.80	.....	4.80	44.8	25.0	81,500	Semi-bituminous steam coal.	3,000,000	Full time.
H. C. Rew	.....	4.31	4.31	36.0	26.0	66,666	Youghiogheny gas coal.	400,000	About ⅓ time.
H. C. Rew	.....	4.66	4.66	48.0	26.0	66,666	Du Quoin nut steam coal.	400,000	" "
Jerzmanowski	7.00	2.85	9.85	Oil fire	27.0	150,000	Naphtha in retorts, crude oil in furnaces	From 150,000 to 1,000,000	" "

1. Not well authenticated, though given in good faith.

2. The figures in this column should not be taken as a criterion of the efficiency of the apparatus, because the constancy with which an apparatus is operated, approaching its full capacity or receding from that point, management and local conditions, always affect the results. The above figures are not quoted as the best obtainable by means of the apparatus named, but are such as came within the writer's observation during a period of over 14 years' practical experience in making carbureted water gas in different sections of this country. In comparing results with our British cousins it should be remembered that the Imperial gallon (British) contains 277.274 cubic inches, as against only 231 cubic inches of the American gallon. In connection with the above table it may be noted that, with the Loomis and Egner apparatus, either anthracite or bituminous coals may be used in the generator; the former when used bringing the pounds of coal per thousand cubic feet of gas made down quite materially. The Rose and Rew apparatus were specially designed for the use of bituminous coal only, to make water gas.

The Regulations for the Supply of Electricity, Compared with those for the Supply of Gas.

[By Mr. Norton H. Humphrys in the London *Journal*.]

A comparison between the regulations affecting supply now usually adopted in Provisional Orders authorizing the sale of electricity for lighting, with those for the supply of gas, as inserted in the Gas Works Clauses (1847) Amendment Act, 1871, shows that the latter have really formed the foundation for the former. Entire phrases and sentences have been transferred from the earlier to the later acts. It is further evident that electricians, profiting by the experiences which have fallen to the lot of gas undertakings, have requested, and been able to obtain, better terms than those granted by the 1871 Act to gas works. At the present time, when active endeavors are being made to bring electric lighting into competition with gas, it may be interesting to examine these conditions in detail, and it is not too much to claim that any privilege granted to electric light companies, but either closed or denied to gas companies, gives an unfair advantage to electricity, of which those interested in gas have a right to complain.

The various enactments by which the supply of gas to the public is controlled and regulated were drafted at a time when the suppliers of gas were supposed to have a clear field, so far as the distribution of a lighting agent from a manufacturing or producing station was concerned. The terms in which they are worded clearly indicate that they aimed at the control of a business that was to a very great extent a monopoly. Gas was regarded as one of the necessities of civilized life—something like the water supply; and the right to cut off or discontinue it was thought to be of such importance that it was limited in various ways, while at the same time penalties were introduced for deficiencies either in the quantity or quality of the supply. The value of the monopoly represented by the right to supply gas was always heavily labored by the representatives of the public, whenever additional or extended powers were sought. It is relied upon as a valuable weapon at all meetings of the "gas consumers' indignation" kind; and it has also been brought out as one of the reasons why the gas supply should be in the hands of the local authorities.

This idea of a monopoly has tempered the tone of the regulations under which gas undertakings are at present controlled to such an extent that anything in the way of the successful establishment of a competitor would operate to their disadvantage in several ways, apart from any question of mere loss of business. Such a state of things as that which would obtain if the electric light companies now being established should succeed in their endeavors to secure the public lighting and a substantial share of the private lighting, was at that time beyond the regions of practical possibility. The electricians, with the fact before them of having to compete with established interests, have not been hampered with this cry of "monopoly;" and they have, on that account also, been able to obtain better terms from Parliament than the gas undertakings could get. It follows that anything which tends to reduce the "monopolist" powers, of which so much has been made, should also be attended with a corresponding reduction in the severity of the clauses that were inserted for the purpose of limiting them. In other words, the position of gas undertakings, as monopolies, is now being changed; and had such changes been foreseen at the time when the present obligations were drafted, it is probable that modifications would have been allowed. It is too much to expect that those who clamored so loudly about "binding down a strong monopoly" will retract their position, according to alterations in circumstances, and propose to relieve the burdens which they assisted in laying on. Any movement in the direction of obtaining relief must come from the gas undertakings.

The terms upon which gas is to be supplied, and the powers possessed by undertakings in respect to their dealings with their customers, will be found in the 1871 Act. Gas companies are bound to furnish a constant supply to all who require it. If this referred to regular consumption only, it would not be so hard; but it also renders them liable to be *in readiness* to supply. If a customer chooses to take only 100 cubic feet per annum, he has a right of damages against the company if they are not prepared to supply at any moment. Summarizing the regulations in ordinary language, they show that any person may demand a supply of gas for premises situated within 25 yards of any main pipe belonging to the company, "or such other distance as may be prescribed in the Special Act." When so prescribed, it is never less than 25, but ranges up to 50 yards. There are the usual clauses as to written notice and security for payment; and also a stipulation that the consumer should bear the cost of pipes laid in private ground, or in any case for all after the first 30 feet. Further, the undertakers may re-

quire a guarantee for at least two years' consumption of gas, amounting in cash value to not less than 20 per cent. per annum on the cost incurred by them in laying the service. This cost is so vague as to be utterly useless in practice, apart from the fact that the cost of a service pipe is now so low as to render the guarantee absurdly small. Suppose that a customer applies for a supply of gas, and there is good reason to believe that the consumption will be small, irregular or uncertain. All that can be done is to demand a guarantee, on the above terms, for a yearly consumption equal to 20 per cent. on the cost of supplying and laying any length up to 30 feet of service pipe. Possibly only 10 to 15 feet of pipe may be needed, or the customer could evade the guarantee by bearing the whole cost of the service. But this guarantee, such as it is, only holds good for two years. The expression used—"at least two years"—certainly affords some ground for extending it beyond that period, if thought desirable; but it is not clear on the point. Whatever the period over which the guarantee may extend, however, the position of the gas suppliers at the end of that time is somewhat puzzling. Have they no further powers as regards guarantee? Or could they threaten to discontinue the supply, and so force a fresh application and a fresh agreement? However this may be, it is evident that the guarantee has no bearing whatever on the supply of gas, but is simply a partial protection against loss on laying the service pipe.

The result of this is that the gas company are bound to be ready to supply, even if the consumer uses no gas from one year's end to the other; and all gas undertakings are burdened with an unprofitable class of customers, including those who use very small quantities, and perhaps only during one week, or even one day, in the year, and those who do not use any for irregular periods, or throughout the summer. Such customers are a loss to the concern, because every customer's share of certain expenses is entirely irrespective of the quantity of gas used by him. The meter inspector must inspect every meter, and the rental clerk enter up the reading. A certain share of the unaccounted-for gas must be placed to the credit of every service and meter, apart from the quantity used through them. If only 100 cubic feet is used, a bill must be prepared, and the collector must call. Even as regards very small accounts, it is well known that a large proportion of small consumers means an equally large proportion of unaccounted-for gas. If the matter was thoroughly inquired into, it would be found that the absence of anything in the way of a minimum charge for gas entailsa considerable loss on the suppliers. The question has never been raised yet, because no urgent necessity has arisen for doing so; nor have I heard of a case where a guarantee of minimum consumption was demanded, except in connection with special circumstances, such as extending the service or main beyond the prescribed limit.

The electricians have secured a very substantial protection against losses of this sort, by the insertion in their provisioual orders of a clause which runs something like this: "They shall be entitled to charge at the following rates per quarter: For any amount up to 20 units, 13s. 4d.; and for each unit over 20 units, 8d." The price named, of course, varies according to each case, but the principle is that a consumer ***must pay for 20 units each quarter***, whether he uses it or not. Even during the summer quarter, not less than this amount must be paid for. Applying this rule to the case of gas, 20 units may be taken as representing 2,000 cubic feet. Every gas company has 5, 10, or even a larger percentage of customers on its books who do not pay for over 1,000 cubic feet in the summer quarters at any rate. The right to charge a minimum of 2,000 cubic feet per quarter, would mean an increase of income sufficient to warrant a reduction in price, and gas companies are placed at an unfair disadvantage, if such a privilege is allowed to their competitors but denied to themselves.

Of course, there is the objection that it is unfair to charge for more than is actually supplied; but if the question is fairly examined, in the light of the facts just mentioned, it will be seen that a minimum charge is a perfectly fair one. It represents the cost of being ready to supply, and interest, maintenance, etc., on the plant concerned in this responsibility. In the case of water companies, there is a minimum charge. If we hire a horse and brougham, the owner expects payment whether we are using it all the time or not. Against the fairness of a minimum charge, it has been urged that a shopman might as well charge all his neighbors for keeping his shop open, as he is ready to supply whether they chose to go in and buy or not; but the case is not parallel. The neighbors who never deal with him have never put him to any expense. To get a fair representation, we must assume that the shopman is compelled by law to keep a space at his counter ready for the use of each neighbor, and, further, to be liable to penalties if the individual t rns up at any time without notice, and finds his place filled. No retail tradesman would expect to provide convenience in this way, without a right to charge. In directing attention, therefore, to the minimum charge, there is no intention of hinting that the electricians have secured more than their fair rights, but what is sauce for electricity is also sauce for gas.

A point in connection with the charge for public lighting may next receive attention. The 1871 Act provides that the price of gas supplied to the public lamps may be settled by agreement, or, in case of difference, by arbitration; regard being had to the circumstances of the case and the price charged to private consumers. So far, this is quite as much as could be expected; but in many Private Acts it has been overridden by a condition, inserted under pressure at the demand of the local authority, to the effect that public lamps should be supplied at the lowest price charged to any consumer. Such a stipulation was brought forward and approved in the spirit already noticed—that of regulating a monopoly—and evidently with regard to the probability that the whole of the streets and public spaces would be lighted by gas, causing the aggregate consumption to be larger than that of any private customer. But it is a strong point with the electric lighting companies to secure, not the whole, but a selection including the cream of the public lighting; and the same authorities who forced the above obligation on gas companies are perfectly willing to favor electricity in this respect. If their endeavors are attended with success, the gas company lose all the high power lamps, and a large proportion of the remainder; being left with a comparatively small and widely distributed consumption in the by-lanes and outskirts. The loss of a privilege should, in common fairness, carry with it the removing of an obligation bearing upon that privilege; and the hardship involved in the obligation to supply the leavings of their competitors at the old rate is too obvious to need further amplification.

We have, however, not yet exhausted the advantages afforded to electricity as compared with gas. The gas companies' powers are usually supposed to cease at the meter; and the consumer can do as he pleases beyond it. If he chooses to vary the pressure in the mains in the vicinity, by suddenly and frequently alterating the rate of his consumption, the company have no remedy. He may put 100 lights on, or cut them off without notice; and I have heard it alleged by a solicitor that the gas company have no right to ask how many lights are in use. The same gentleman, by the way, has since proved perfectly willing to allow an electric lighting company the right to inspect the whole of his wires and lights as often as they choose. But clause 21 of the 1871 Act seems to give power to enter the consumer's premises and inspect the fittings at all reasonable times. This clause may be useful in case of a disputed account, or where a meter has failed to register; but it is not often used, and many undertakings have preferred to drop it entirely for the sake of working peaceably with their customers. This power to inspect, whatever it may be worth, evidently has reference only to questions relating to the quantity of gas consumed, and the charge for the same. There is no right to raise a question as to the suitability or efficiency of any appliance in use.

The following extracts from Electric Lighting Provisional Orders, however, point to a different footing: "Provided also that if the owner or occupier * * * uses any form of lamp or burner, or uses the energy supplied to him * * * so as to unduly or improperly interfere with the efficient supply of energy to any other body or person, * * * the undertakers may discontinue to supply energy to such premises. The undertakers shall not be required to supply any premises unless they are reasonably satisfied that the electric fittings are in good order, and not calculated to affect injuriously the use of energy." These clauses admit a large extent of control right up to the point of consumption. They are further of use in aiding the electric company to control the supply of fittings, which is a very important branch of the business, and in many cases furnishes (at present, at any rate) the chief part of the profits. Persons will naturally hesitate about placing an order for electric fittings with a local tradesman, when there is a risk that the company may condemn the whole. The important feature, however, is that, whereas gas companies are helpless in the matter of controlling wasteful or careless usage, the suppliers of electricity have, very wisely, secured considerable powers in this direction.

If a gas consumer uses burners which obtain, let us say, only one-fourth of the value that might be secured by the use of proper appliances, and then goes away and states that the gas is four times as costly as it need be, or if he uses cheap and inferior fittings, with the usual result of constant leakage (which is also placed to the credit, or rather to the discredit of the gas company), there is no remedy. Perhaps it may be said that the consumer is amenable to reason, and will not wilfully waste gas; but the proportion of dirty iron burners, small pipes, and gingerbread fittings to be found in use in any room, testifies to the fact

that the consumer is either too indolent, or that he regards the advice of the gas company as more likely to benefit them than himself. Possibly he prefers his own ideas or those of his gasfitter; finding it costs nothing to grumble, while new appliances are not to be had on such good terms. Whatever the reason may be, he keeps on in the same old way. But the suppliers of electric light, under corresponding circumstances, have the right to say that the fittings are not in good order, and to refuse the supply. They secure, in effect, the right of insisting that their product shall be properly used; and they do not object to compare the results derived under such circumstances with those obtained by the medium of the dirty iron burners, etc., for gas.

Lastly, there is the fact that the electricians have a unit of price that is really a unit. For all practical purposes, 100 cubic feet is the unit of price for gas, although it is usually expressed at per 1,000 feet, and the latter rate is the one stated on the bills. There is much to be said in favor of one plain unit for gas such as electricians have; and 100 cubic feet would do well for the purpose, under some distinctive title. Suppose it was simply called a "hundred." Such a statement as "109 hundreds at 4d. per 100" is simpler and more readily understandable by small tradesmen than "10,900 cubic feet at 3s. 4d. per 1,000;" and it carries a better impression to have a low priced unit than one that runs into shillings and pence.

At present the cost of electricity delivered at the consumer's residence, as compared with gas, is so great as to prohibit anything in the way of serious competition; and the matters above mentioned are of no actual importance in practice. If, however, circumstances so changed as to enable it to compete with gas in point of price, the case would be different, and the need for something like equality in regard to legal obligations would be apparent.

Do Iron and Steel Crystallize in Service?

Mr. Paul Kreuzpointer, in a most interesting article on this subject, contributed by him to the *Iron Age*, remarks:

In the writer's article on the above subject printed in the *Iron Age* July 5 mention was made of the liability of the best soft iron to break with a crystalline fracture under certain conditions, thus creating the impression in the minds of the uninitiated that the iron had turned crystalline from its original fibrous state. It may be remarked here that the term "crystalline fracture" is very often applied without warrant of facts. A fracture is crystalline only when the shining particles which we observe are duly formed with more or less well developed angular bodies, bearing the characteristics of crystallization. But there are many fractures of iron and steel which present shiny facets, it is true, but are nothing else than the transverse section of the fiber of the material, or crushed original crystal, which formed while the fluid or semi-fluid mass of the metal was slowly cooling and was subsequently rolled out or hammered down and elongated according to the amount of work put on it. Now these crushed and more or less elongated crystals cannot be properly called crystals any longer, and hence the fracture of rolled and hammered iron and steel exhibiting the transverse section of these crushed crystals in the form of a shiny angular surface is more properly termed granular. But to many who are not familiar with these characteristics a granular fracture is crystalline in appearance, because of the similarity, and they jump at the conclusion that the iron or steel crystallized in service. With them this opinion assumes the form of a conviction, because of the occasional appearance of a really crystalline fracture or of a nest of crystals.

The latter may be due to insufficient work which did not break up the crystals in the bloom or ingot, or the crystals were formed in the overheated shaft or axle, etc., which was left to cool slowly, after being finished with strokes of the hammer so light that they did not penetrate to the center.

Many erroneous conclusions would be eliminated from daily practice if due discrimination were always made in the case of so-called crystalline fractures of what is granular and really crystalline. It is not venturing on uncertain and speculative ground to assume without much fear of contradiction that on proper investigation by a competent person really crystalline fractures would be found never to have been fibrous in the first place.

The writer ventures to say that 19 out of 20 of all the so-called crystalline fractures are counterfeits, and ought to be classed as granular.

Now, then, what are the conditions which produce this granular fracture? Let us fix the fact in our minds that the destruction of any metal, in our case iron and steel, must have a beginning. This beginning must necessarily manifest itself by a change in the position or form, or both, of the particles composing the metal. This change of position or form is ordinarily caused by an extraneous force pulling, pushing, squeezing, twisting or bending the metal.

The strains thus operating set the particles in motion, the extent depending on the degree and nature of the force producing the strains. The motion of the particles thus set up we call the flow of the metal. The softer a metal the easier will it flow under a given strain.

Now, let us bear in mind that wrought iron and structural steel flow comparatively easily. But we have already seen that flow must begin with a change in the form and position of the particles of the metal. However, it is evident that with the first change of form or position of a particle it has become something different from what it was; it has become more or less distorted. Consequently, if we can in any manner break iron or steel before flow begins, then we will obtain a transverse view of the particles of the metal as they existed when broken. Thus we can break even the softest stay bolt iron with a granular fracture if we can break it transversely before flow begins. The essential requirement to accomplish this is that one part of the metal be rigidly and immovably fixed around the periphery of the metal so that the force breaking the metal must spend more time to set the particles in motion and cause them to flow than it takes to break the metal through. The softer the metal the tighter and more rigid must be the grip on the portion held firmly and the quicker the action of the breaking force.

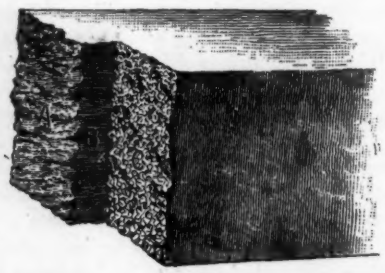
Nicking, flaws, coarse texture and other circumstances facilitate the result. Stay bolt iron is thus very frequently broken granular in boiler shops after the bolt is screwed home. The writer once saw the roof sheet of a stationary boiler which had blown off. Every stay bolt showed a beautiful granular fracture. There was a universal condemnation of the builder for putting in steel or cold short iron, while others were handy with their crystallization theory. But neither was right; the iron proved of excellent quality, pieces of the stay bolts could be bent double and closed upon each other under the steam hammer with one stroke without showing the least crack in the thread. In short, the so-called crystalline fracture, which was very fine, indicating good quality of metal to the expert, was nothing else but the transverse section of the fine fibers, produced by the lightning like quickness of the explosion, which did not give time for the particles of the iron to flow before rupture took place. It is obvious that there occur in everyday life and practice innumerable combinations of circumstances which tend to produce various and modified results.

But the underlying principle remains the same. That iron and steel become fatigued by shocks and variable strains is now recognized and has been pointed out by the writer several times in the columns of the *Iron Age*. That an axle, a shaft, or a beam is more liable to break when in such a weakened state is natural. Then it will break more easily transversely without flow, a granular fracture being the consequence. But the practice to anneal pieces of machinery at stated times to restore the fiber, as it is erroneously called, is proof in itself that in case of breakage with granular fracture the breaking of such articles was not due to the change of fiber to crystal, but to a state of the metal which is called fatigue, consisting probably in a beginning change of position of the molecules, in a disturbance of the cohesion. This disturbed condition is brought back to a normal condition by the annealing.

The annealing certainly cannot produce fibers in the metal if there were none before. It may be readily conceived that a member of a structure, though apparently designed large enough, is weakened by a nest of crystals. The good metal surrounding this nest has to carry a greater load, becomes fatigued there sooner than at any other place where the metal is good all through, breaks at that weak place, and the granular fracture commingling with the really crystalline portion is so deceptive in appearance that in conjunction with other apparently inexplicable factors the engineer is willing to swear by the beard of the prophet that the iron has turned crystalline in service. If we take a fracture of that kind, plane and polish a portion of it transversely and longitudinally, and examine it under the microscope, then a rational explanation of a supposed mystery is obtained.

If soft steel, which under a nicking test shows amorphous fracture, breaks granular in a mysterious way in a structural member or other article, then it is more likely that the heater in the mill has been laboring under the influence of a summer night's dream while at work than that a gentle fairy had turned the fibers, so called, of the steel into crystals. In such a case again the original dimensions may have been all right, but the overheating weakened the metal in certain portions, and fracture will naturally occur unexpectedly in those portions. The ability to judge by sight in such a case whether the metal had been overheated originally is worth more to the engineer than a cartload of books treating on the crystallization of iron under shock and vibrations.

In the accompanying cut a form of granular fracture is illustrated, which is met with in almost innumerable variations, corresponding to the shape of the material, the manner of breaking, the degree of intensity of strain, and the molecular condition of the metal at the point of fracture. Supposing the facets of the fracture to be comparatively large and bright, those lacking the experience of frequent comparison with



similar fractures would conclude this to be a genuine case of crystallization due to shock and vibrations. But while *A* and *C* give the appearance of being crystalline, at *B* we see fibers. Why? Because there is no crystal anywhere near that fracture. A crystal is an angular body, varying in size, bounded on all sides by flat surfaces or facets. Consequently in a longitudinal fracture of iron and steel we have a right to see at *B* the angular surfaces of crystals if the fracture were truly crystalline, and not the stratified surface of bundles of fibers.

Again, since crystals will not break through their bodies when torn apart, but separate along their respective sides, the crystals of iron, which are comparatively large, if they are not crushed by rolling or hammering, will stick their heads out boldly wherever they come to the surface, and these are seldom met with in rolled or hammered iron for reasons explained before. If they are met with it is due entirely to bad scrap being mixed with good iron, scrap which was burned before the good iron got to a good welding heat, or it is due to insufficient work which did not break up the original crystalline structure. It is found in every puddle ball and ingot, leaving the material with more or less coarse texture, which, on breaking transversely, will have a close appearance to crystalline. Or the article was overheated before or after finishing, which would also tend to produce coarse texture and greater liability to fracture. Finally, the article, if a long piece like a shaft, axle or bridge member, was ignorantly heated on one end or in the middle; this would leave a blue heated portion or zone of metal somewhere along the line between the heated and unheated portions, with a consequent disturbed molecular state and internal strains at that point, a coarser texture and great liability to break transversely at that particular point without warning with the usual appearance of a granular fracture. The latter, owing to surrounding mysterious (?) circumstances, is taken for a case of recrystallization of fibrous material.

[Concluded from page 481.]

A Gas Manager's Experiences in Japan.

[By Mr. William Newbigging, in the *Gas World*.]

The condensers were made out of cast iron pipes, not that I prefer this kind of condenser, but from motives of economy. We had a number of cast iron pipes that answered the purpose. It is almost a necessity that condensers should be covered over with a light roof, for the purpose of keeping off the hot rays of the sun in summer, and the heavy rains and snow, of which there is an abundance, in winter.

As regards napthaline, we were not troubled with it to any great extent except at the inlet to the exhauster; and it took some little time to account for that. The foul main, coming through the retort house wall, at a considerable height from the ground, and running down the wall, entered the condenser at the bottom, and was exposed to all weathers. I therefore came to the conclusion that here was the source of our trouble. I tried wrapping it in straw, but this did little good. The pipe was then disconnected and taken down inside the house, and from that time our naphthaline troubles ceased.

We erected one tower scrubber only, leaving room for another. This latter I did not put in, experience having taught me that the proper way to deal with the ammonia impurity is to have one tower scrubber only, to pump weak liquor into it, and let the gas afterwards pass through a washer scrubber. In this way all traces of ammonia are most effectually removed. I am not in favor of dispensing altogether with the tower scrubber, as some engineers are doing at the present time, preferring, as I have said, to have one for the purpose of bringing up the weak liquor to the proper strength, by pumping it over and over again, thus also effecting the removal of much of the H_2S and CO_2. The wood-filling in the scrubbers, the grids for the purifiers, and the other woodwork required about the buildings, were prepared by a native carpenter e.. ployed on the works.

The ammoniacal liquor was sold to a company started for the purpose of making artificial manures, sulphate of ammonia included.

The purifiers were six in number, but very small; and one, at least, had to be changed every morning. This was done by the lamplighters before going to their ordinary duties. Artificial oxide (made from iron filings and sawdust) and lime were used as purifying agents, and kept the gas pure. We were under no restrictions in regard to impurities.

The gasholder tank was constructed of cast iron plates, with rust joints. This form of tank was decided on before I had experience of the capabilities of the native workmen as bricklayers; and seeing that the land on which the tank had to stand was made ground, reclaimed from the sea, perhaps it was best. In constructing a tar tank, later on, I had, however, little difficulty in making a tight tank with bricks and puddle, and at much less cost than if it had been of iron.

The number of canals which intersect Tokio at every point, and make it in many respects not unlike Venice, necessitates the taking of some of the mains underneath the bridges. No great span is required, however, and, consequently, no great difficulty is experienced in doing it.

The company distributed the gas over a large area, our furthest consumer being fully 7 miles away from the works. The consumption of gas in the daytime was small, except at the Imperial University. Though there is a large field for gas as a motive power in Tokio, I cannot think it will be largely, if at all, adopted for cooking. Charcoal is cheaper, and in the hands of the Japanese answers the purpose equally well.

The street lanterns generally were of tinned copper. These were made on the works by our own fitters. In addition to the repairing of the gas meters, we carried on an extensive gasfitting business. Glass lusters are to be recommended for use in any tropical or semi-tropical country. The number of insects which are constantly about, clinging to the gasfittings and soiling them, soon spoil the appearance of brass or lacquer, whereas the glass is easily cleaned by using a damp cloth.

By way of pendant to the present article, I may relate that before I left I paid a visit to a natural gas field in the north of Japan, in company with a Japanese gentleman of considerable standing, a capitalist, who had an idea of starting a manufactory there, provided the gas was found in sufficient quantity. On arriving in the district we found that the natives utilized the gas by driving a bamboo pole about 8 to 10 feet into the ground, carrying the pole up to the eaves of the roof. Along the eaves they fixed another pole, and into this a short piece of iron tubing. The gas finds its way up through the bamboo, and is lighted on reaching the outlet; and as all the houses are treated in this way, and the gas costs nothing, the village is illuminated every evening. A bamboo driven into the ground provides the inmates of the kitchen with sufficient gas for boiling water and for cooking.

I had been previously informed that in this district there was a well of water through which the gas bubbled, and as the gas was said to have been alight without intermission for 700 years, it was looked upon as little less than sacred, pilgrimages from far and near being made to the well, which is situated within the grounds of a temple.

Not caring to leave the district without having a glimpse of this wonderful light, we betook ourselves to the house of the priest in charge of the well. He received us with great politeness, and on our telling him that we had come all the way from the capital, he expressed his regret that neither the well nor the light was on view. The former was closed and the latter was out; had we come a month sooner, during the pilgrimage season, we should have seen it in full working order. "But," we replied, "it is generally reported that this light has been burning 700 years, and has never been extinguished." With a smile that was "childlike and bland" he invited us into a room at the back of the temple, and over a cup of tea and a pipe of tobacco explained to us that such was not the case. In the summer the light burns with great regularity, and a sufficient quantity of gas bubbles through to keep it burning. In the rainy season and the winter, and when the barometer is low, the pressure of the gas is inadequate, and the light goes out. I told the priest that what he wanted was a gas producer at the back of the temple, and there would then be no risk of the well losing its reputation. My efforts to push business were, however, unsuccessful. We left him, and called, on our way back, to see the method of collecting oil. This is done by digging a well about 3 feet in diameter and the same in depth. The well is left for two or three days, and then the accumulated oil is scooped out and filled into barrels. The industry is a small one, but it might be developed with advantage.

Waste of Coal in Mining.

[Read by Mr. Selwyn M. Taylor before the Engineers' Society of Western Pennsylvania.]

My material and theories for the construction of a paper on the waste of coal in mining are mainly from my experience in the Pittsburgh coal bed, but what applies to the Pittsburgh coal bed will apply with but very slight variations to all the bituminous measures in the United States, from the Alleghenies to the Rocky Mountains.

Theoretically there is no obstacle in the mining and removing of all our approximately horizontal coal veins, and practically this is the case, excepting such loss as is caused by accident, tradition and careless management. The Pittsburgh coal seam, probably the most valuable in the world, by reason of its extent and valued characteristics, has an average thickness of form from 12 to 14 feet, but of this only from 5 to 9 feet is commercially valuable, the remaining portions of the vein being so interspersed with strata of slate as to render them worthless. Therefore, the thickness of coal, as the term is commonly used, is from 5 to 9 feet. The Freeport veins of coal in the lower coal series, mined extensively in Northern and Central Pennsylvania and Ohio, vary from 2 to 9 feet in thickness. The coal measures of England, Germany, Belgium and other European countries, together with the anthracite mines of our own country, generally lie at a far greater depth below the surface than do the bituminous fields of the United States. This, together with the fact that the coal strata of Europe and the anthracite measures of Pennsylvania, are of generally a deep pitch, varying from 20 to 60 degrees, cause to be left in the mine from 20 to 60 per cent. of their entire coal areas in order to support the overlying strata, and thus prevent the squeezes or crushes, which would probably cause the loss of an entire mine plant. The larger part of this coal is absolutely lost. From the fact that many of our miners and mine bosses received their education and prejudices in the mines of Europe, can be traced the cause of leaving considerable quantities of coal where there has been no necessity of doing so in our own fields in the past. It has, however, been fully demonstrated that the surest way to avoid a squeeze or crush in our mines is to mine the coal as rapidly and systematically as possible, withdrawing all pillars and supports as fast as the system in use will permit, thus breaking the overlying strata, and allowing it to fall and rest on that which is under the coal, and thus leaving no weight overhanging the remaining pillars, which must be maintained to support main entries and air-ways to the last of the mine.

Prior to 15 years ago, there was little or no careful, scientific mining done in this district, and few of the operators of mines knew anything of the inside of their mines, trusting the work entirely to the mine boss, who very frequently abandoned large bodies of coal because of some minor difficulty in the hauling or drainage without the knowledge of the owner, rather than mine at an increased cost per ton, the mine boss's ability being entirely gauged by the amount of coal he could produce per diem at a minimum cost. At the present time I am working in four separate mines to recover coal willfully abandoned under that style of management, and for one acre we recover, there are 50 acres that are lost beyond all possibility of ever reclaiming them.

Without any exact figures to support my claim, except those taken in cases in which I have had occasion to make careful examination, I would say that, of all the coal in the Pittsburgh seam mined prior to 1870, 50 per cent. of it at least was abandoned because of trifling difficulties and improper systems of mining. From that time until the present matters have steadily improved, owing to the increased cost per acre of coal and the decreased price received by the operator for every ton of it, making economy and careful, scientific management absolutely necessary, though there are still some few operators scattered here and there throughout our immediate vicinity who adhere to old methods and cannot understand why they are running their mines at a loss.

The surveying and mapping of the mines in every detail, as required every six months, according to the Coal Mine Act of this State, make it now practically impossible for the mine boss to willfully abandon any coal without the knowledge of the engineer, and consequently that of the operator. In the mines I have charge of, I require every mine boss to report to me at the time of each semi-annual measurement, the loss of any rooms or ribs that we may not be able to get in, and I am thus enabled to investigate the loss of any coal.

Take one company as an example in the improvement in the amount of coal mined from a given area, in 1883 I made a complete survey of their mines, making a careful measurement and calculating the areas closely of all the unmined coal owned by the company. Deducting this from the area that had originally been owned by them I found that they had worked over some 600 acres in 20 years, and during that time had been considered as owning one of the best set of mines in the district. Taking the amount of coal mined as shown from their books, an average production per acre was shown of 3,600 tons of lump coal. This mine, up to that time, had been worked on the single entry system, a system under which nearly all the entry pillars had been left in the mine and abandoned. Changing this system as rapidly as possible to that of the double entry system, concentrating our workings as much as possible, and adopting the system of pushing each working place to completion without delay, in the course of the next four years of the mine had been brought to an average production of 4,700 tons of lump coal per acre, which has been steadily maintained, varying but a few tons each year to the present time. This amount I estimate to be about 98½ per cent. of the possible available production per acre in that thickness of coal. There being no statistics in existence showing the production per acre throughout the entire district, I can only form my estimate in a general way from such mines as I have examined and verbal statements made to me by engineers and operators. But from these I would place the average production per acre of the Pittsburgh coal, that is, of coal actually shipped at the present time, to be about 85 per cent. of the entire amount. At the end of the next 10 years I hope to be able to report fully 97 per cent. of all the coal that is under operation being recovered and shipped.

One of the causes of waste of coal in the mines is of comparatively recent origin, that is, machine mining. It is apparently not possible to mine our coal on any other system than that of "room and pillar" with very slight modifications, the room being 21 feet wide, leaving a 12 or 13-foot pillar, which is, or should be, immediately withdrawn on the completion of the room. No machine has yet been invented that will mine the ribs with safety, and consequently, in machine mines, after the room has been driven to its destination by machine, there is a tendency to temporarily abandon the rib instead of starting in at once by hand mining, as should be done, simply because hand mining is a little more expensive, and the matter is put off until some time when there will be more profit in the coal. This time never comes, and a room once temporarily abandoned is very apt to be permanently so, as in a few years falls and breaks will make it absolutely impossible to recover abandoned ribs. These ribs, amounting to ¼ of the coal, coal which, with its development in the way of track laying, entry driving, drainage and haulage, probably standing on the books of the operator at from $600 to $1,000 per acre, is permanently lost, and in one mine alone that has been operated by machine mining for a great many years, at least 100 acres of coal have been lost in this way.

In certain sections of the Pittsburgh coal district, comprising not a great many mines, a modification of the "room and pillar" system of working coal has been used for many years and has resulted in a loss of from 20 to 30 per cent. of the entire area passed over in mining. Under this system the rooms are driven wider than usual, with the roadway in the center, and the pillars are purposely abandoned. It has been claimed for this that it prevented the upheaval of the strata under the coal, but from my experience I would say that was not the case, and that, in addition to losing the amount of coal left in these pillars, many mines have been injured in the way of a squeeze or a crush caused by their having been left.

From time immemorial it has been the custom to pay the miner for the number of tons or bushels of lump coal (that is, all the coal that pass over the meshes of a 1¼-inch screen), and to pay him nothing for the finer grades that go through. This was, probably, in order to induce him to mine in as large sizes as possible, but it eventually resulted in the miner loading on his wagon nothing that he could help but the large coal, leaving as much of the fine coal as he could behind him. This resulted in a loss for many years of from 5 to 10 per cent. of the entire amount mined being left forever in the mine. There has been a determined and successful effort on the part of the operators, however, during the past few years, to compel the miner to load all the slack and fine coal in the mine. The result at the present time is that not more than 1 per cent. of the product is being left in the mine.

In summarizing the production and waste in the mining and shipping of Pittsburgh coal, I will take as a basis an average thickness of vein of 4 feet 6 inches, which prevails within a radius of 30 miles of Pittsburgh, and comprises at least 80 per cent. of the amount of coal that is being shipped as raw coal, though of course the production is a great deal larger per acre in the so-called thick coal veins and in the Connellsville region where the product is not shipped as raw coal. Assuming the specific gravity of our bituminous coal at 1.4 (a fair average), the actual weight of an acre of coal 4 feet 6 inches thick would be 7,657 tons. The best result I have ever been able to obtain from a considerable area of coal, the average per acre is as follows :

4,650 tons of 1½-inch or lump coal.
1,425 tons of nut coal.
1,425 tons of slack coal.

Total, 7,500 tons per acre.

I would place the average production per acre of the Pittsburgh coal of 4 feet 6 inches thickness at:

4,226 tons of 1½-inch or lump coal.
1,137 tons of nut coal.
1,137 tons of slack coal.

Total, 6,500 tons per acre.

This is an average loss of possibly 1,000 tons per acre, which is worth under the tipple an average price as "run of mine" coal at 80 cents per ton or $800 per acre, or more than four times the first cost of the average acre of coal. While this proportion of loss is quite large compared with our own ideal standard, based on what is possibly in the most perfect bed of coal in the world, yet when compared with the amount of coal recovered from the anthracite and other than the bituminous beds I have spoken of, our results are surprisingly good. A very few years ago a member of the State Geological Survey estimated that not over 27 per cent. of the anthracite coal in a given area mined was actually shipped to the market, the balance being lost in pillars and breaker waste.

Teachers and Text Books in Mathematics in Technical Schools.

By Mr. Mansfield Merriman, C.E.

As an introduction to the discussion of this subject the following propositions or theses are advanced: First, in pure mathematics the text book is more important than the teacher. Second, teachers of mathematics in technical schools should be in sympathy with, or have had experience in, practical engineering work. Third, a revision of mathematical text books from the technical point of view would be of great benefit to teachers and students, and lead to better results in all directions.

Regarding the first proposition, it is sufficient to say that an exercise in mathematics involves careful preparation on the part of the student. The text book usually contains all that is necessary for students of average ability to thoroughly understand the lesson assigned, and the function of the teacher in the class room is mainly to keep order, incite the laggards to activity, and see that the students have understood the principles and solved the problems. While a good teacher will do much by his personality to increase the interest of the class, it is, after all, the text book which molds the habits of thought and methods of investigation. The mathematical text book is also one of the tools which the student consults and uses during his subsequent course of study and practice, and thus its influence extends over many years. Languages and practical engineering subjects can be taught without books, but in mathematics they are indispensable both for teacher and student, unless the class be very small. It is therefore important that the character of text books should be such as to promote habits of clear thought and accurate computation, and lead to a practical mastery of the methods of mathematical analysis. The second proposition will seem self-evident to all teachers of engineering. It may be doubted by those who claim that mathematics should be studied for the sake of discipline, or for the sake of theory itself as a part of scientific knowledge; but this view is not now held by our best educators. Mathematics furnishes no better discipline than can be obtained from the study of Greek, botany, history, or any other subject. Mental discipline comes from hard work, continued thought, and a desire to thoroughly master the subject and discover new truths. In engineering courses of study mathematics is an instrument or tool which the student is to use in actual investigations, and if it be taught from this point of view better results both in respect to mental discipline and actual knowledge are likely to be secured than if practical applications are left altogether out of sight, as is often apt to be the case. It is not uncommon in many technical courses, particularly those given in universities, that teachers in mathematics are employed who are recent classical graduates without practical experience of any kind. One case which has come to my knowledge is that of such a teacher who was given charge of a class of engineering students in analytical mechanics, although he had never studied the subject; it was said that he was quite successful, but how much better he might have done if he had been over a course in applied mechanics and had had experience in its practical applications to structural work or machinery. Nothing lends greater interest to the truths of mathematics than that they can be applied to the promotion of the welfare of mankind, and as engineering is one of the professions having this as its object, no one can seriously doubt that teachers of mathematics should be in sympathy with the main lines of technical progress.

The third proposition naturally follows as a corollary from the first and second, unless it be maintained that mathematical text books are now perfectly adapted to the needs of engineering students. After consultation with many teachers of mathematics and engineering, I have found none who does not think that the books can be improved. A successful revision that shall break away from some of the old established precedents and introduce methods in harmony with lines of actual technical applications would exert a great influence upon mathematical teaching. Such a proposed series would perhaps involve a slightly different arrangement of the various branches and partial redistribution of the hours of the course of study. A new series of mathematical text books, when so many are now in the market, would not be seriously suggested unless it was thought that very great improvements could be made in the direction indicated. Thoroughly believing this, I offer the following thoughts as to the main features that perhaps should characterize such a revision.

A series of mathematical text books for the courses of study in technical schools, covering all and perhaps more ground than would be necessary, might embrace seven volumes: (1) algebra, (2) geometry, (3) trigonometry, (4) mensuration and computation, (5) analytical geometry, (6) calculus, and (7) higher mathematics. The subjects of descriptive geometry and mechanics will not be considered here as they do not properly form a part of a course in pure mathematics. The subjects of algebra and geometry, although generally required for admission to engineering courses, are included in the plan, since the preparatory schools need to be especially influenced in sound methods of instruction.

The book on algebra might profitably differ from those in general use by omitting or abridging the topics of ratio and proportion, permutations and combinations, harmonic progression, indeterminate equations, continued fractions, inequalities, convergence of series, and everything relating to logarithms. On the other hand, equations of the third and fourth degrees, the binomial formula, indeterminate coefficients and imaginary quantities should be more fully elaborated, and be illustrated by many examples and problems. Horner's method and Sturm's theorem need not be treated in this volume as the former comes properly in the course in computation, and the latter cannot be thoroughly treated without a knowledge of the calculus. The graphical representation of algebraic expressions and equations, now quite unnoticed in most books, should be introduced early and form a prominent part of all discussions.

In regard to geometry, the text books in common use seem to need more revision than those on any other subject. They are largely algebraic, filled with signs and symbols, not only for the common operations, but for such words as parallel, angle, and square, all of which is not conducive to clear and accurate reasoning. The subject of geometrical teaching has received much attention in England, and I think it is the general conclusion that Euclid furnishes the best basis for a beginner. Personally I have always been thankful that in youth circumstances threw in my way a copy of Euclid, and I know of no mathematical book which is likely to exercise a greater influence in promoting clear thought and logical reasoning. The proposed volume on geometry might include the first three or four books of Euclid, followed by propositions and problems to be solved by the student himself, while the remaining books might be arranged according to the more modern order, preserving, however, Euclid's style of demonstration. Geometry is not merely the deduction of beautiful and valuable truths, but it is a powerful instrument for investigation; most American text books seem to dwell too much on the former, so that often engineering students are very deficient in powers of geometrical reasoning. A partial return to the method of Euclid might hence be advantageous.

In trigonometry the work should be limited to plane triangles and the discussion of circular functions, spherical triangles being postponed until later in the course where they can be studied by civil engineers and be omitted altogether by mechanical and electrical students. Tables of natural functions should be the only ones here introduced, since the practice of studying logarithms and trigonometry simultaneously is objectionable for many reasons. A four-place table of natural sines and tangents will well illustrate all classroom problems in trigonometry and is sufficiently precise for a large part of actual engineering work.

The course in mensuration and computation is suggested on account of the marked incapacity of students and graduates to perform numerical operations with intelligence and precision. In such a book the common

rules for mensuration would occupy only a small space, but the subject of observations and their errors would receive notices and methods of conducting numerical computations be fully inculcated so that the precision of a computed result may properly correspond with the data. The theory and use of logarithms would here also find its place, with applications not only to trigonometry, but to numerous other problems. The theory of interpolation in numerical tables and methods of computing tables would be discussed. Graphical computations and representations might be introduced with advantage, and if thought best, the slide rule might be used for some of the numerical work.

Analytical or co-ordinate geometry comes next in order, and here too much space should not be given to the investigation of the conic sections, but curves of other classes should be freely used. The actual construction of many of these curves from their equations should be made on cross section paper, the constants being varied so as to show the different species. Graphical methods for the solution of equations would also be interesting and valuable. A book on this subject, however, need not be lengthy, since the full discussion of the properties of curves can better be made by the help of calculus.

In regard to calculus, it seems to me that differentiation and integration should be taught simultaneously. Integration is not a direct process, and the many bulky volumes on the subject contain nothing more than the algebraic reduction of given differentials to forms whose integrals are known. For this part of the work a dictionary of integrals might be given in which the student could find the integral of a differential by referring the latter to its proper class, genus and species, perhaps according to a classification analogous to that used in botany. Engineers and mathematicians always have their books at hand when an expression is to be integrated, and in this case students should have the same privilege. Numerous practical exercises and problems should be given in order that the method of analysis may be fully grasped, and it is more important that the fundamental methods should be thoroughly understood than that an extended course in differential equations should be rapidly covered.

The last volume of the series, called "Higher Mathematics" for want of a better name, would include chapters on miscellaneous subjects, only a few of which need be read by any one class. Modern synthetic geometry, spherical trigonometry, hyperbolic trigonometry, determinants, probability, higher differential equation, vector analysis, quaternions, the theory of functions, and perhaps non-euclidean geometry might be discussed, together with some account of the history and literature of mathematics. A few chapters of this book would furnish an excellent review of parts of the previous course, besides giving an introduction to methods which are daily coming more and more into use in technical investigations.

In conclusion, it may be said that the above thoughts are presented with the hope that the time may come when students in technical schools will pursue their mathematical studies with greater interest and better results than at present. Having never taught pure mathematics I cannot represent at all the opinions of professors of that science, but from consultation with many teachers of engineering, I feel that some views here expressed will meet their approval. It will not be possible for me to attempt the preparation of a series of books on the plan suggested, but if some of the younger members of this Society would take the matter in hand much good work might be done for the promotion of sound mathematical education in technical schools.

Stokers and Pokers.

[Communicated by Mr. Thomas Newbigging to the London *Journal*.]

The heading of my communication will be clear enough with a word of explanation. A good many years ago—in 1849, I believe—a work was published under the title which I have adopted. The book in question was, so far as I remember, a kind of history of the constitution and administration of a line of railway from its humblest workers upwards. My definition of "Pokers" is not that of the author of the work named. The pokers to whom I refer, instead of poking the usual kind of fire to make it burn brightly, exert themselves in stirring up strife between employers and employed; causing the fires of enmity and spite and hate to glow and burn with all but unquenchable fierceness.

There is also another class of pokers—philanthropical and emotional pokers—who may be described as poking their noses into other people's business; whether it may be the business of the workmen or their employers, or of both. So much by way of preface.

The employees of gas works may be conveniently divided into four classes—viz., (1) skilled workmen, (2) stokers, (3) laborers, and (4) the official class, such as engineers and managers, secretaries, chemists, clerks, foremen, storekeepers, meter inspectors, and collectors.

I estimate that in the United Kingdom there are employed in, or in immediate connection with gas works belonging to local authorities, statutory and non-statutory companies, and private individuals and firms, about 68,000 persons altogether, classified as follows:

10,000 *Skilled Workmen.*—These consist of brick and retort setters, blacksmiths, engine tenders, main and service layers, meter makers and repairers, and fitters.

23,000 *Stokers.*—These may be described as a higher class of laborers, or as semi-skilled workmen, employed in retort charging and drawing, and furnace men.

26,000 *Laborers.*—These comprise coal and coke wheelers, men employed in the purifying house, in the yard, and in outdoor work, assisting the main and service layers and fitters, including also the lamplighters.

9,000 *Officials.*—These are the engineers, managers, secretaries and others.

The total amount paid as wages and salaries in gas undertakings in the United Kingdom may be set down at about $25,000,000 per annum, distributed as follows:

Among the	10,000 skilled workmen	$4,160,000
"	23,000 stokers	7,990,000
"	26,000 laborers	6,350,000
"	9,000 officials	6,500,000[1]
Total..	68,000	$25,000,000

This expenditure as wages is not all on revenue account, for a portion is for capital purposes. The average per man seems to work out at a somewhat low figure; but it must be remembered that the proportion of laborers is large, and neither these nor the stokers are all constantly employed.

The skilled workmen receive, on an average,	$8	00	per week.
" stokers " "	8	75	"
" laborers (men and youths) "	5	25	"

The skilled workmen and laborers work 54½ hours per week, and the stokers nominally 56 to 78 hours—depending upon whether they are on 8 or 12-hour shifts. At some gas works, labor on Sundays is largely reduced.

The officials and the skilled workmen are kept employed all the year round. The number of stokers at work necessarily varies from month to month; but a considerable proportion are employed all the year at their proper work of carbonizing.

When the heavy lighting season is over—say, about the middle of March—many of the stokers are employed at their respective gas works during the intervening months, to about the middle of September (when the heavy lighting season begins), in main and service pipe laying, on general repairs, and in painting the gasholders, the roofs of buildings, and other ironwork. Recently, Mr. Frank Livesey, the Engineer of the South Metropolitan Gas Company, instead of dispensing with his disengaged stokers at the end of the season, employed the whole of them during summer in the excavating and concreting work required in the construction of a huge gasholder tank. In this way their services were retained all the year round without a break.

In summer, such of the stokers and laborers as are not kept on at the gas works, go laboring elsewhere—some for bricklayers and masons; others find employment on steam vessels as stokers and even as sailors, and in the later season many of them go harvesting. It may be said that, as a general rule, a gas manager endeavors to retain good men in his employ during the whole year. In any case, stokers, if they have been working away, are usually only too glad to get back to the gas works on the approach of winter.

The stokers' hours of labor—actual labor—are comparatively short, though it may appear to the uninitiated that men on 12-hour shifts have long hours. The long hours, however, are only apparently so; the actual hours of labor per day being not many in reality. The idea which is entertained by the outside public as to the long and severe 12 hours' labor of gas stokers needs to be corrected. Mr. W. W. Hutchinson, of Barnsley, from careful observation, found that a stoker on a 12-hour shift is actually on the gas works premises not more than 10½ hours, of which, for 4 hours 39 minutes he is engaged on the most arduous part of his work, and 1 hour 44 minutes on light work, such as any strong lad could perform. This gives a total work of 6 hours 23 minutes, and the remaining 4 hours 7 minutes are spent in rest and at meals. Hence it is seen that the stokers work fewer hours a day than almost any other class of laborers. I am not now arguing in favor of 12-hour shifts, but simply stating facts.

1. This includes directors' and auditors' fees, collectors' commission, etc.

The work of stoking is by no means so laborious and continuous as has been represented. A dock laborer's work, for example, is both harder and more incessant, and worse paid. So is that of a coal miner. Neither of these has the same comfortable quarters in which to do his work; neither are the sanitary conditions and environments anything equal to those enjoyed by the stoker. Certainly, there is exposure to great heat during charging and drawing by hand; but a steady man thrives and grows strong in face of it. The ventilation of a retort house is generally excellent—far superior to that of the stokehole of a steam vessel, or even to that of a coal pit. There is abundance of fresh air, and usually plenty of clean water at the service of the men employed in a retort house. The work is not of a dangerous kind. When ordinary care is exercised, it is a rare thing for a stoker to be injured in following his daily occupation.

The labor of stokers cannot be considered as skilled labor in the proper and usual sense of that term. True, some modicum of skill is required in the handling of a shovel, a scoop, and a rake; but a fortnight's practice enables an ordinary intelligent laborer to perform the work of a gas stoker efficiently. This has been proved over and over again.

Gas works stokers have this important advantage on their side, on which emphasis should be laid: They have good, steady, secure, and well paid employment during the whole winter; whereas many skilled tradesmen—such as masons and bricklayers especially, and to some extent joiners and house painters, and the vast army of ordinary laborers—have to live often for many weeks together, when the weather is severe, in enforced idleness, with no wages coming in at the week end By severe weather, I mean unfavorable weather, such as during frost, snow, and rain. At such times outdoor work is largely at a standstill.

In many gas works the stokers have a room provided, where they can take their meals in comfort, and sit and read the newspapers; and in some instances baths are set apart for their use. I speak advisedly when I assert that, looking at the whole of the facts dispassionately, it may be said, without exaggeration, that gas works stokers are the aristocracy among laborers.

The Manchester and Salford gas strikes of 1890-91 were deeply discreditable to those who instigated them; and the lesson taught by them should not be forgotten. The men had had conceded to them all they asked for, both in regard to wages and hours of labor; but, not content with this, they wanted to dictate to the Gas Committees what hands they should employ. They tried to oust certain non-union men, and because the demand for the dismissal of these men was refused, they struck work. The Salford stokers, it was admitted, had no grievance at all; but they came out bodily, at the call of their advisers, to support their Manchester mates. The leaders of the men lost their heads—if ever they had any, being inflated with the success of their agitation in the matter of hours and wages. They did not deserve the title of leaders—misleaders would better describe their action. There is not a stoker in Manchester and Salford to-day who would not agree with what I now state.

In the interests of the men themselves, and in the interests of labor and laborers throughout the the kingdom, it was fortunate that the leaders and their dupes were ignominiously defeated. It was not a question as to whether Trade Unionism was or was not a good and desirable thing. Most or all of us sympathize with workmen in their laudable efforts to better their condition by unity of purpose and action. The question was whether it was right to use brute force to compel, and be permitted to succeed in compelling, workmen on the one hand and employers on the other, to submit to the arbitrary decrees of a tyrannous conclave, who were prepared to crush freedom of action and freedom of contract on the part of employed and employers; and this, observe, after the reasonable demands of the men had been already complied with.

I am of opinion that a rise in the wages of gas men generally would have taken place in the prosperous years of 1890-91, even if there had not been any agitation. The feeling among gas engineers and managers was that the workmen ought to share in the general prosperity. The strikes that took place, or most of them, were not on the question of wages or hours, but rather on that of the employment of non-union hands, and an attempt to dictate to employers what men they should employ.

As to the remedies for strikes, I suggest: (1) Sweet reasonableness on the part of both employers and employed. (2) Wise leaders of the men; failing that, (3) bitter experience on the part of the men of the work of unwise leaders. A good cause calculated to win public sympathy will shorten a strike when it occurs; and the side that deserves that sympathy will win. (4) The introduction of machinery for economizing labor. (5) Habits of thrift in workmen. (6) Fewer facilities for drinking—which weakness makes men reckless and improvident. (7) The education of workmen's wives and daughters in domestic economy and cleanliness in the home. (8) Profit sharing, where it can be applied.

Mr. George Livesey would probably place the latter first. I should be inclined to place it about midway, if it were universally applicable. But, as a remedy, profit sharing has its limitations, even where it can be applied. "Man shall not live by bread alone." Again, it cannot be adopted by local authorities, some of whom do not make profit (or but little) beyond paying the interest on capital, and providing a sinking fund to redeem capital. It will answer better in some places than in others. In certain large towns, for example, it would do, where there is the possibility, by reason of the constantly growing gas consumption, of making large profits; but in many less favored places it is only possible to earn the bare statutory dividends without unduly raising the price of the gas.

I do not agree with voluntary or extemporized outside interference, whether as intermediaries or otherwise, between masters and men, unless both sides desire to submit their case to such umpirage, and agree to abide by its decision. It otherwise does more mischief than good. A quiet talk and discussion of grievances between the contending parties would sooner lead to a settlement of disputes and differences than any interposition of persons ignorant of the conditions, and swayed by emotional influences, rather than by knowledge and reason. Unfortunately, a false pride on the part of both the disputants generally prevents this desirable *rapprochement*. If this mistaken pride could be removed, and a reasonable mind substituted for it, strikes, when they occurred, would be of short duration. I fear, however, that so long as human nature remains what it is, nothing will prevent occasional strikes; but that their number and severity can and will be minimized, I have no manner of doubt.

The Municipal Ownership of Subways.

Mr. C. H. Morse thus discusses this subject in *Paving:*

Is it reasonable to require the placing of wires underground; and, if reasonable, who shall own the conduit in which they are placed? Is each company to have its own, or shall one company construct the necessary conduit and lease space to the various companies? or shall the municipalities assume the position of landlords? In answer to the first question, as to whether it is reasonable to ask a company to bury its wires, allow me to say that the chief of the electrical bureau of the city of Chicago has repeatedly stated, over his signature, that the city of Chicago maintains 1,100 arc lamps of 2,000-candle power each, which burn every night and all night, and that the cost does not exceed 19 cents per lamp per night. In that city every inch of this arc light city wire is underground in conduits owned and maintained by the city. Compare this with 40 cents per night, which is paid by the city of Boston for the same class of service, with all the wire overhead, and I think the question of the economy of underground construction is settled.

The telephone company have acknowledged that it is better for them to bury their wires, by voluntarily doing so.

The important question for us to consider is whether it is necessary that each company operating wires shall build its own subway, or whether all wires could be safely operated in one.

From the standpoint of superintendents of streets, I have no question you would unanimously vote for one conduit, if the same were practicable. No one questions for a moment that it is perfectly safe to operate all kinds of telephone and telegraph wires, which are commonly called low tension wires, in one conduit. But when the question comes, can we safely place high tension wires in the same subway, a very important addition is made to the question. Theoretically, there are difficulties in the way. But after years of practical success in the cities of New York, Chicago and Philadelphia, where the cities have low tension wires in the same conduit with high tension wires, it certainly seems that the theorist who claims this can not be done must acknowledge that it is practically a success.

Prof. Barrett, city electrician of the city of Chicago, who has had the largest experience in underground construction of any man in this country, is an advocate of municipal ownership of subways, and is positive in his assertion that it is perfectly safe and practicable to operate all kinds of wires in different ducts in the same subway.

It is but natural that each company should prefer to own its own conduits, as this gives to them franchise rights of great value, which are practically perpetual. And with the telephone companies, the ownership of their conduits means, of course, the perpetuation of their monopoly, as at the expiration of their patents all the principal streets in our cities would be provided with telephone conduits, and the people would

not be willing to have the streets torn up for the admission of a competing company. If, however, the conduits were owned by the municipality or a conduit company, space could be leased to individuals for private line instruments, and if thought best, to a competing telephone company. Therefore, I think you will readily see the motive which induces the telephone company to fight this proposition to the bitter end.

The question of municipal ownership of electric light plants is being vigorously discussed, and there is no doubt that many of our large cities will operate their own plants within a comparatively few years. And it would be very much to their advantage to own the subways for their wires, and have a right to require the telephone and telegraph companies and the railway companies to operate their wires in this city subway, at a fair rental.

Thus from an economic standpoint, we would all agree that for a medium sized conduit it would be better to have this joint occupancy, with separate manholes for high and low tension wires, and only one trench.

As the citizens are to pay the interest on the money invested by all of these corporations, they have the right to demand that the work should be done in the most economic manner.

As to street men, I feel sure that I need not enlarge upon the advantages of municipal control of our streets, which, under existing laws, is gradually being taken away from the municipalities.

In conclusion, I would say that the question to be considered has resolved itself into one of three methods. Shall each company be allowed to construct its own subway, which would make in some streets in the city of Boston eight different subways, as is now the case in one street in Philadelphia? Or shall the right be given to a corporation to construct one or two subways and lease space to the various companies? Or shall the municipality, for the sake of the control of its own streets, construct these subways and lease space to the companies?

Direct Current Lighting at High Pressure.

Engineering Magazine notes that one of the most unique and technically ingenious plans for lighting a town of moderate size which has come under its notice is that which has for the past two years been in operation in the university town of Oxford, England, and was described by Mr. Thomas Parker in a paper read before the British Association, published in the London *Electrical Engineer* of August 17th. The conditions which confronted the projectors of this plant were by no means favorable to economical or profitable results, and no small credit is due to the engineers by whom they have been so successfully met. In Oxford, the principal consumers are the colleges, and hence anything like a full load can only be obtained during term time. There is a maximum load for even half the plant only during some eight weeks of the year, and hence the system must necessarily be very elastic to be able to show even fair results. It was also necessary to locate the generating station at a distance of 4,500 feet from the center of the area to be lighted, which of course compelled the employment of high pressure currents. After much consideration, a high pressure continuous current plant in conjunction with motor transformers and storage batteries was decided upon. At the power house the currents are generated at an e.m.f. of 1,050 to 1,100 volts, and are thence conveyed to a distributing station, through two pairs of mains insulated with indiarubber, laid underground in iron pipes. Each motor transformer consists of a field magnet and an armature with primary and secondary winding, having a commutator at each end. Full details of this apparatus are given in the paper. The secondary mains are made up in two sizes in the form of armored cables. These are laid in a trench under the sidewalks, and are provided with disconnecting branch boxes, so that any section or street can be cut out. The high tension feeders to the transformers are of similar cable. At present seven motor transformers are used in five sub-stations.

The storage battery at the distributing station is capable of sustaining a discharge of 120 amperes for 8 hours, and takes care of the load from 1 o'clock A.M. until half an hour after sunset. The battery is charged by a small motor generator, giving an output of 100 amperes and 33 volts from its secondary armature, being supplied from the secondary mains at an e.m.f. of 103 volts on its primary. The 33 volts from the secondary armature is put in series with the secondary mains, giving an aggregate of 136 volts, which is sufficient to charge the cells. This is found to be more economical than charging from the secondary mains with a regulating resistance, the total efficiency being 92.5 per cent. At the generating station three inverted triple-expansion condensing engines are employed, running at 125 revolutions per minute, and driving three separately-excited Elwell-Parker dynamos, each having a capacity of 80 amperes at 1,100 volts and 400 revolutions. These are connected to bus-bars, so as to be run singly or in parallel as required. The "load-factor" of the station works out only 5.93 per cent. By this technical expression is understood the ratio of units of current sold to units that could be sold with the lamps always on, viz.:

$$\frac{\text{Metered watt-hours} \times 100}{\text{Mean watts installed} \times \text{number of hours in the year.}}$$

For the greater part of the year only about half load for one engine is ever required, and in view of this fact the following results of the year's working from July 1, 1893, to June 30, 1894, must be regarded as quite remarkable. The aggregate kilowatt hours generated were 195,022, and the total metered 122,081, of which 18,303 were supplied for public lighting, and 2,019 k.w.h. were used at the distributing station.

The total efficiency of the system was 64.6 per cent.; that of the transformers 76.7 per cent., including losses in mains and resistances, and that of the battery 43.9 per cent. The total kilowatt hours unaccounted for were 6,976 units, or not quite 5.5 per cent. Omitting this loss in computation, the coal used amounted to 6.43 pounds per k.w. sold, costing .752d. (1.5 cents) per k.w. The number of 8 c.p. 35-watt lamps installed was 5,060 at the beginning and 7,774 at the end of the fiscal year. The total cost of all generating expenses, including rent and taxes, was 3.715d (7.43 cents) per k.w delivered to consumers. The total revenue for the year was £3,715 8s. 2d., or approximately $15,000, the k.w. consumed averaging 18.2 per lamp throughout the year, for which the average price obtained 7.3d. (14.6 cents) per k.w.h. It is doubtful if another station can be found in the world of such small capacity and with such wide variations of load in different parts of the year, which can make so good a showing.

The Determination of Benzene in Illuminating Gas.

In a paper by Messrs. Noyes and Blinks on this subject, the authors remark:

Some time since Hempel and Dennis described a method of determining benzene vapors in illuminating gas which depends on their absorption in a very small quantity of absolute alcohol. The amount of mercury required and the difficulty of applying the method as described by these authors led us to attempt the determination with the use of a Bunte burette. The results were so satisfactory that it seems worth while to describe our method of procedure.

One hundred cc. of gas are taken in the burette and measured, either as usual, with a column of water of definite height above, or, perhaps, better, with a side tube or bottle attached below so that the gas is brought to atmospheric pressure. The water is then completely removed from the cup of the burette above and the water in the burette is drawn down to the lower stopcock as usual for the introduction of reagents. Instead of introducing the alcohol from below, however, two or three cc. of absolute alcohol are poured into the cup above and allowed to enter the burette, one cc. at a time. After each admission of the alcohol enough time is given for it to thoroughly run down before more is admitted and care is taken that the walls of the burette are uniformly moistened with the regeant. After withdrawing the alcohol below in the usual manner, two or three cc. of water are admitted above and withdrawn below and then more water is admitted above till the gas is brought to the original pressure, and the volume read.

To test the accuracy of the method, several determinations of the amount of benzene in the gas described in the last paper, were made. This gave 1.2, 1.3, 1.2, 0.5, and 1.2 per cent. The fourth determination was evidently in error for some unknown reason.

Twelve cubic feet of the same gas were passed through a meter, then through two large calcium chloride drying tubes, and then through three Drechsel wash bottles, containing absolute alcohol, and a fourth empty bottle to condense vapor carried over, all being surrounded by ice. On dilution with salt water, 16.8 cc. of liquid hydrocarbons were obtained. Considering these hydrocarbons to consist of benzene, they would occupy in the form of vapor at 20° a volume of 4.46 liters. Twelve cubic feet are equal to 340 liters, of which 4.46 liters is 1.31 per cent. When we consider that a portion of the hydrocarbons obtained must have consisted of toluene, naphthaline and other hydrocarbons, whose vapors would occupy a smaller volume than benzene for a given weight, the agreement is satisfactory.

MR. CHAS. J. MORROW has sold to the New York and Cleveland Gas Coal Company 30 acres of coal land in Penn township, Pa., the consideration for which was something like $10,000.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following further matter respecting the death of Mr. Van Leer Eastland is from a correspondent at Oakland, Cal.: "I have to announce the death, at Oakland, Cal., on the 8th of September, of Mr. Van Leer Eastland, Superintendent and General Manager of the Oakland Gas Light and Heat Company. Mr. Eastland was born in the city of Nashville, Tenn., in 1835, and was therefore 59 years old at the time of his demise, which was due to heart trouble. Mr. Eastland had been identified with the gas interests of the Pacific Coast since 1854, at which time he was in the employ of the San Francisco Gas Light Company. In 1867 he took charge of the Oakland Gas Light Company, in the capacity of Superintendent and General Manager, and maintained that relation with the Company up to the time of his death—a period of 27 years—his whole service of 40 years, with a brief interval of rest, making him the pioneer of Coast gas superintendents. The works with which he was connected grew under his management from a plant having a daily capacity of 5,000 cubic feet of output to one having a capacity of three-quarters of a million, while in later years, connected with it and adding to his arduous duties, was an electric light station having a capacity of 1,100-horse power. To the discharge of the duties he brought the honor, integrity and policy which distinguished him amongst men. Of a retiring and modest disposition, he did not herald forth his works, but they stand as a monument to his memory. He will always be held in sincerest affection by those who were connected with him in the business of his life."

MR. FORREST E. BARKER, of the Massachusetts Board of Gas and Electric Light Commissioners, is seriously ill. The malady from which he suffers is typhoid fever.

THE Western Gas Construction Company, of Fort Wayne, Ind., is under contract to furnish a set of improved Lowe water gas apparatus for the Nyack (N. Y.) Gas Light and Fuel Company. The contractors will also erect two purifying boxes under the same contract. We are especially well pleased to note this, since it shows that Mr. Voorhis, of the Nyack Company, has at last determined to carry on the gas supply of this bustling Rockland county settlement in accordance with modern ideas. He will, beyond a doubt, soon convince Senator Lexow (who is one of the leading spirits in the local electric lighting company) that good gas can easily hold its own with electric lighting, especially when the former is in competition with an electrical current of rather weak voltage; for of such is the volume of the famous investigating Senator's dynamic service in and about Nyack.

"OBSERVER" forwards the following, under date of September 27th: "The annual meeting of the Brookline Gas Light Company was held yesterday, and about a dozen shareholders, representing 6,787 shares out of a possible 10,000, were present. The sales of gas for the year amounted to 139,442,558 cubic feet, and the average price received for the same was $1.21½ per 1,000. The mileage of mains is returned at 115, and this means more than double the length laid something over a year ago. The average cost per mile of the new main system is returned at $4,160. The gas averaged 26 candles in illuminating value. The Directors chosen were: Robert Amory, H. H. Rogers, Sidney Chase, F.W. Lawrence and R. A. C. Smith. Mr. Smith is a new member of the Board, replacing Col. L. B. Marsh. Mr. Harcourt Amory was re-elected Treasurer, and Mr. Charles L. Crehore was elected Clerk, in place of Mr. George M. Stearns. A motion to have the annual reports of the President and Treasurer printed was amended to the point of referring the matter to the Directors, with full power. The meeting was perfectly harmonious; in fact, it resembled merely the perfunctory indorsing of something which had been arranged at other times and places."

AT the adjourned meeting of the Woonsocket (R. I.) Gas Company, the Directors chosen were: Henry C. Kimball, John W. Ellis, George M. Welles, Joseph E. Cole, Gilbert Darling, Joseph B. Aldrich, Frank Harris, A. H. Rankin and E. H. Rathbun.

THE new plant of the Marlboro (Mass.) Company is completed.

THE Trustees of the municipal natural gas plant, of Tiffin, Ohio, have sent out a circular to a number of the factory and foundry operators of that city, containing the notification that, owing to the inability of the city gas field to answer all the drafts made upon it, gas will be shut off after October 10th. The establishments that will have to resort to solid fuel under this order are: The John A. Hall Brick Works, U. S. Glass Company, Ohio Lantern Company, American Strawboard Company, Heilman's Brick Works, Londenslager's flouring mill, Hubach's brewery, Tiffin Brewing Company, Heabler's flouring mill, Tiffin Woolen Mills, Sneath & Cunningham, and Loomis & Wyman, foundrymen, Edison Electric Light Company, Brewer's Pottery, National Machinery Company, Sterling Emery Wheel Company, W. S. Bacon's flouring mill and the Tiffin Manufacturing Company.

MR. JOHN ENGLISH, Treasurer of the Bridgeport (Conn.) Electric Light Company, died at his home in New Haven, Conn., on the evening of Sept. 30. Deceased, who was in his 34th year, was prominent in the administration of the National Electric Light Association.

THE Grand Rapids (Mich.) Gas Company recently sued Messrs. Sproul & McGurrin, local contractors, for damage to its mains (occasioned by defendants while putting down a water main), and secured judgment.

MR. W. S. HAYES, of Little Rock, Ark., has been appointed receiver of the Crawfordsville (Ind.) Water and Light Company.

THE proprietors of the Meridian (Miss.) Gas Light Company have decided to erect an electric lighting plant, on a site between the Northeastern and Mobile and the Ohio Railroads, near 27th avenue. It is to replace the plant that was destroyed by fire some time ago.

THE City Council, of Evanston, Ills., with commendable foresight, has turned a stony glare on the proposition of Mr. Moody and his associates to be granted permission to operate an opposition Company in that city.

THE Montreal Gas Company has declared a semi-annual dividend of 5 per cent., and when it has paid the promoters of the Consumers Gas Company $400,000 in its shares, at par, for the aforesaid Consumers property, franchises, etc., the old Company's capital will amount to $2,897,704.

MENTIONING this about the Montreal Company reminds us of the reasons that have been put forward by Mr. John Coates (who, with his partner Mr. King, and their associates, are to share the $400,000 of stock, at par, to be issued by the Montreal Company) for selling out their interest in the Consumers Company: "Briefly stated, the reasons are as follows: First, the lack of sympathy and support from the press in the fight generally, and especially in the recent injunction cases, whereby we were compelled not only to stop the supply in the city, but to cut off from 150 to 200 consumers, thus causing them great inconvenience and annoyance. We were surprised and disheartened at the action, or rather inaction, of the press in the litigations and decisions against us by the courts. Secondly, we have also been greatly discouraged by the treatment received at the hands of the citizens themselves—as long as our price was lower than the old Company's we had no lack of applications, but when our opponents reduced their price to our level, many of these applications were cancelled, even after the mains were laid for the very purpose of supplying such consumers, and unless we could have obtained two-thirds of the consumption in each street it was impossible to make the enterprise pay a fair interest on our outlay, because the price left too narrow a margin. My health has been anything but good of late, and my doctor urged me to give up the worry of litigation. I have heard of the lack of public spirit and enterprise in Montreal, but could not credit such. Now I have to say it is in my opinion unfortunately too true. I had to get the bulk of my capital outside of Montreal, and even after building my works and proving my *bona fides*, they did not rally to my support, and have themselves to blame for the result. At the same time I am deeply grateful to the few who stood loyally by the new Company, and I firmly believe that the fight, short as it has been, will result in a great benefit to them and the public generally." Poor Mr. Coates, how he has been misserved!

THE proprietors of the Plymouth (Pa.) Light, Heat and Power Company have placed a contract with the Western Gas Construction Company, of Fort Wayne, Ind., for a special setting of the Construction Company's improved Lowe water gas apparatus. The contract also includes a set of purifiers and other minor apparatus.

THE City Council of Stillwater, Minn., has renewed the contract for the public lighting of that city for one year with the Stillwater Gas and Electric Light Company.

THE following are the provisions of the by-law, respecting the gas division of the application for a charter, made to the City Council of Winnipeg, by the promoters of the Dominion Gas and Electric Company:

"The Company agrees with the city to sell and supply gas in the city of Winnipeg at a rate not to exceed $2.25 per 1,000 cubic feet, and in consideration of the said Company agreeing to sell and supply gas at a rate not exceeding the rate above mentioned, it, its successors and assigns, are hereby granted, subject to the rights of any Company now existing, the exclusive right to make, sell and supply gas for lighting or heating purposes, within the city of Winnipeg, for the period of 35 years, during which period, subject as aforesaid to the rights of any Company now existing, no other person or Company shall sell or supply gas for lighting or heating purposes within the said city. Such exclusive right shall expire at the expiration of the said 35 years, and after the said period any other Company shall have the right to compete with the said Company in the supply of gas within the said city limits. The city agrees with the Company, in consideration of the advantage to be derived from the reduction of the price of gas herein agreed to be made, to ask for the ratification and legislation of this by-law by the Legislature of Manitoba."

AT the shareholders' meeting of the Tonawanda (N.Y.) Gas Light Company the officers chosen were: President, J. H. DeGraff; Vice-President, A. G. Kent; Secretary, Joseph Wolf; Treasurer, L. G. Stanley. A contract for a new boiler plant was also ordered awarded to Messrs. Armitage, Herschell & Co.

AT the last regular meeting of the Lamp Committee of the City Council, of Lancaster, Pa., the subject of street lighting was the chief business considered. During the discussion of the resolution offered by Mr. Snyder at a prior meeting of the Council, which authorized an investigation and examination of the arc lights furnished by the Citizens Company, for the purpose of determining whether or not the lamps maintained by the Company were up to the candle value stipulated in the contract, Mr. Snyder moved that the Clerk be instructed to draw up a resolution empowering the Lamp Committee to employ one or more experts to make "tests or measurements of the volume or actual candle power of the light furnished by the Citizens Electric Light Company, the Lancaster Gas Company and the Pennsylvania Gasoline Company." The resolution also provided that in case the candle values were deficient, "proper deductions be made in payment of the bills submitted by the respective Companies." The resolution was adopted.

THE following is from the Doylestown (Pa.) *Intelligencer* of Sept. 27: "The Directors of the Doylestown Gas Company, at meeting held this week, adopted a new schedule of gas rates, to take effect October 1st: Where gas is used exclusively for illuminating purposes the rate is to be $2 per 1,000; for lighting, heating and cooking, $1.75 per 1,000; for heating and cooking only, $1.50 per 1,000. The reduction of 20 per cent. is an item which must forcibly appeal to gas consumers. Hereafter no contracts will be made, and the two or three now remaining in force will not be renewed. Meter rates are to govern in all cases. Mr. H. Weingartner will act as Superintendent of the works."

A CORRESPONDENT at Passaic, N. J., forwards the following, under date of September 29th: "The *Call*, of Paterson, N. J., in its issue of to-day, contains a card from the United Gas Improvement Company, announcing a reduction in the gas rates at Paterson to $1.50 per 1,000, net, the rate to apply to gas consumed on and after October 1st. The Company has for some time been considering this step, but has been awaiting such improvement in business as would warrant it. The reduction at this time, in advance of the expected development of general business activity, is a praiseworthy concession to its consumers and the public. In this, as in previous reductions, the Company has shown its intention of treating its patrons fairly and liberally, and the uniform courtesy of the management has made many friends. The popularity of the Company is in a very large measure due to the fact of its being in the hands of such men as Mr. William H. Rodgers, the Agent, and Mr. William L. Williams, the Superintendent. The Gas Company has no opposition in its line, and yet it has been remarkably liberal and considerate to its patrons from the start. This reduction, right at the beginning of the long nights of winter, will be greatly appreciated by its present consumers, and will no doubt greatly increase its list of patrons. Some time ago Mayor Braun and other citizens asked the representatives of the Company for a reduction in price, and were assured that the matter was even then under consideration, and that the reduction would be made as soon as the necessary preliminaries were arranged. These preliminaries have been arranged, and the price is reduced, to take effect on October 1st."

MR. R. A. PAGE, of Portland, Oregon, informs us that Col. H. H. Nelson, of St. Paul, Minn., head of a syndicate of Eastern capitalists who invested heavily in Seattle (Wash.) property three years ago, has commenced an action against R. C. Elliott and John Mather on promissory notes aggregating nearly $60,000, which may result in his acquiring their stock in the Seattle Gas and Electric Light Company. The Puget Sound National Bank, of Everett, is also made a party, because of an alleged interest, which Nelson says is inferior to his. The copartnership of Elliott & Mather in June, 1892, executed to Colonel Nelson and G. M. Nelson, two promissory notes, dated at St. Paul, each for $5,000, payable four months after date and bearing 10 per cent. interest. The property in the notes was afterwards transferred to H. H. Nelson. Elliott & Mather executed another note, also dated St. Paul, August 4th, 1892, for $10,000, payable to H. H. Nelson, 60 days after date, and bearing 10 per cent. interest, and on October 26th borrowed from Nelson $37,728.85, at 12 per cent., which they agreed to pay within five months. In order to secure the payment of the notes and loan on January 12, 1893, Elliott & Mather transferred to Nelson certificates for 1,604 shares of stock in the Seattle Gas and Electric Light Company, the consideration being named in the agreement as $60,000. The shares were assigned to G. M. Nelson, as trustee, and on July 30 placed in the custody of the Minneapolis Trust Company, of Minneapolis, under an agreement between the Trust Company, H. G. Struve and others. It is alleged that no part of any of the several amounts due has been paid and Nelson asks for judgment on each account, the principal sums footing up $57,728.35, and that the stock be sold and the proceeds applied to the debt. Nelson also has begun another suit against Elliott & Mather, and sets forth a contract made February 18, 1892, whereby he sold and agreed to deliver to them certain shares of stock of the Land and River Improvement Company, of Everett, and also certain shares of the South Everett Land and River Improvement Company, on payment of $8,416.22 with 8 per cent. interest, within 90 days. Nelson retained the stock as security for the payment. The $8,416.22 became due May 18. Nelson says that prior to bringing suit he offered to assign the stock sold to Elliott & Mather, but they would not accept his offer. He says the sum is yet unpaid, and therefore asks for judgment according to the contract and that the shares be sold to satisfy the debt. Elliott & Mather have not yet answered the complaints, that is, the papers are not on file; but Nelson's reply is already in the Clerk's office. It denies that defendants have paid $1,800, as alleged in the first affirmative defense, and alleges that Nelson has fully performed his part of the contract and accounted for moneys received under it. He further says that he paid to them various sums of money, which they have refused to pay back, and that there is due now an additional amount of $2,518.29. He denies that he refused to deliver to them books and accounts referred to in their answer, and avers that the books have always been open to them."

THE following are the rates agreed upon by the City Council of Tacoma, Wash., in respect of an electric lighting service in that city—the electric system is under the control of the municipality:

Arcs, to midnight, each per month					$10 00
Each additional arc,	"				9 00
Arcs, all night, each	"				15 00
" " " additional, per month.					13 00
Incandescent lamps, 16-candle power, to 10 o'clock					1 00
" " 16 " " to 2 o'clock					1 50
" " 16 " " all night					2 00
" " 32 " " to 10 o'clock					2 00
" " 32 " " to 2 o'clock					2 75
" " 32 " " all night					3 50
" " 16 " " all day					1 25
" " 32 " " "					2 50
Residence lights, 4 and over					1 25
" " less than 4					1 00

THE Rutherford and Boiling Springs (N. J.) Gas Company has changed hands. We will have an authentic report of the changed conditions, probably in time for our next number.

RUMOR has it that some of the shareholders of the Newark (N. J.) Gas Light Company are opposed to the plan of consolidating the gas interests of that city, the arrangements for which are in a very forward stage.

WE understand that a movement to start a gas and electric lighting plant at Harriman, Tenn., is contemplated. It does not seem probable that the scheme will be completed, for the place is neither populous nor progressive. It is in Roane county, not far from Oakdale.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,

PROPRIETORS.

MONDAY, OCTOBER 8, 1894.

The Market for Gas Securities.

The market for city gas shares is rather dull, although prices have not suffered any material decline for the week, Consolidated being returned at to-day's opening (Friday) at 120½ to 122. Standard common is in demand, and the bashful common of the New York and East River Company is being jobbed about in small lots, at 21¼ "bid." Equitable is fairly steady, and Northern is well above par. Brooklyn shares are erratic, being strong and weak in spots, the weakness being most marked in Metropolitan, while Williamsburgh shows the greatest strength. Nassau, however, shows the greatest consistency in value, and Mr. Leggett keeps that peculiar smile of his very much in evidence.

Although we still think the Companies are not far apart respecting ultimate consolidation, nevertheless it is also probable that the deal in process of framing may at any moment be overturned. At the quoted prices, it looks to us that all classes of Brooklyn gas shares offer more profit on the sales than the purchasing side. Chicago gas is buoyant, having sold up to 74¼ this morning. The dividend is payable on the 22d inst. It is cheap for investment at anything under 80. Baltimore is bid for at 67⅛, and Bay State is stronger, at 29¾ to 30½.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 Wall St., New York City.

October 8.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	120½	122
Central	500,000	50	103	—
" Scrip	220,000	—	100	—
Equitable	4,000,000	100	170	175
" Bonds	1,000,000	—	106	108
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	145	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	348,650	50	50	—
" Bonds	100,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	27	35
Preferred	5,000,000	100	79	82
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	116
Citizens	1,200,000	20	50	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co.	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	—	160
" Bonds	300,000		103	—
Peoples	1,000,000	10	75	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	145	—
" Bonds (5's)	70,000	—	—	155
Nassau	1,000,000	25	170	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	175	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	29¾	30½
Income Bonds	2,000,000	1000	44	45
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	80	83
2d " " "	3,000,000	1000	59	—
Buffalo Mutual, N. Y.	750,000	100	120	—
" Bonds	200,000	1000	95	100
Chicago Gas Company.	25,000,000	100	73⅝	73¾
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	56	60
Bonds	600,000	1000	92	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal			90	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt	11,000,000	100	67⅝	—
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
Con. Bonds	.....	.....	—	50
East River Gas Co., Long Island City	1,000,000	100	20	22
Preferred	.....	.....	36	38
Bonds	500,000	100	81	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	18	19
Preferred "	2,500,000	100	72	74
Bonds	9,034,400	1000	88½	89
Little Falls N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
New Haven, Conn		25	200	—
Oakland, Cal			42⅜	43
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Peoples, Jersey City	500,000	—	175	185
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	80	85
Preferred			90	95
Bonds			90	95
Syracuse, N. Y	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal	10,000,000	100	71	71½
Washington, D. C	2,000,000	20	240	—
Wilmington, Del	500,000	50	188	190

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About 10,000 gallons daily supply of

Ammoniacal Liquor,

8 to 10 oz. strong. Address

1009-4 "AMMONIA," care this Journal.

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT COMPANY, DREXEL BUILDING, PHILA., Sept. 27, 1894.

The Directors have this day declared a quarterly dividend of two (2) per cent. ($1 per share), payable on October 15, 1894, to stockholders of record at close of business October 1. Checks will be mailed.

1009-1 EDWARD C. LEE, Treasurer.

DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK, 71 BROADWAY, NEW YORK, Sept. 14, 1894.

The Board of Directors have this day declared a dividend of one (1) per cent. on the preferred stock of this Company, payable on October 10, 1894, to stockholders of record at 3 o'clock P.M., October 1, 1894.

Transfer books will be closed from 3 o'clock P.M., October 1, to 10 o'clock A.M., October 11, 1894.

1002-2 FERDINAND McKEIGE, Secretary.

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As Superintendent of a Gas Works or Gas and Electric Plant Combined.

At present in charge of gas and electric plant with output of 12,000,000. Active pushing young man, with 10 years' experience. Good reasons for making a change, and can give good references from past and present employers. Address

10.8-2 "SUPERINTENDENT," care this Journal.

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1002-1 Menominee, Mich.

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IS THE MOST ECONOMICAL GENERATOR IN THE WORLD, BOTH IN COST AND OPERATION.

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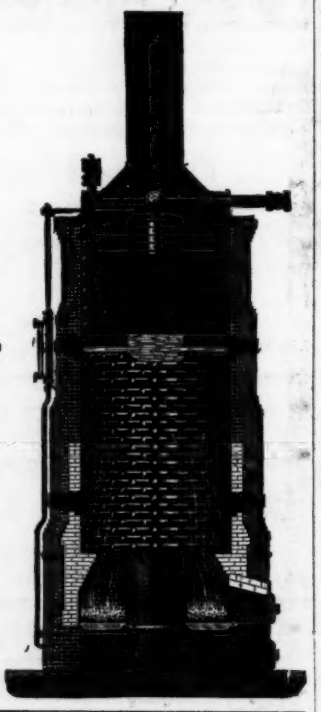

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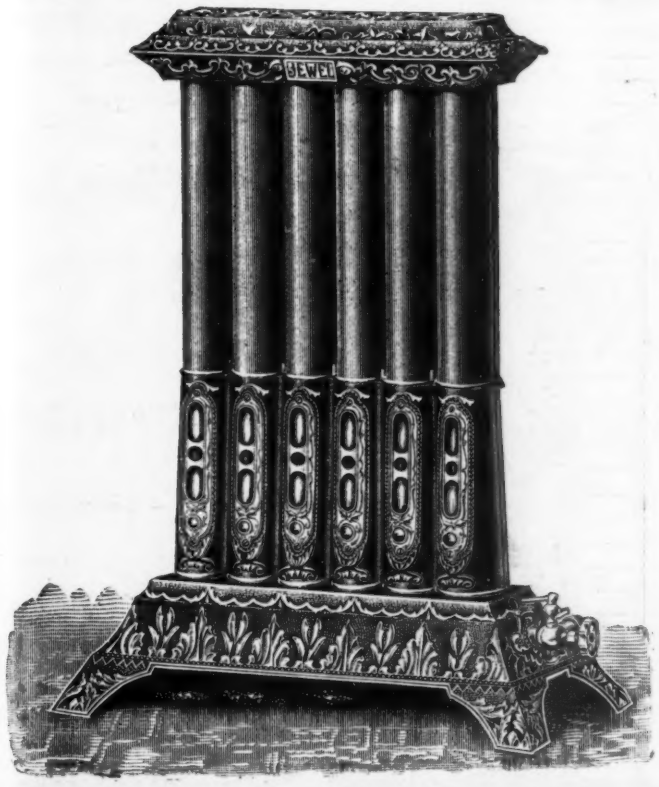

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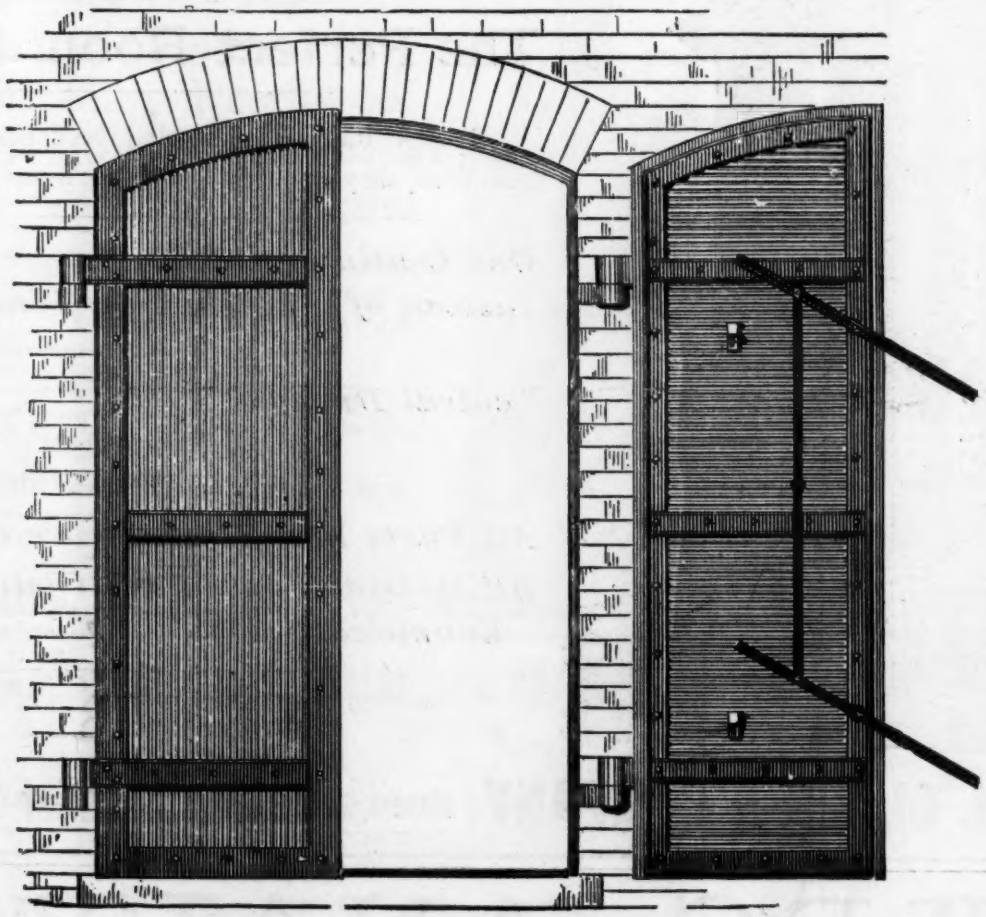

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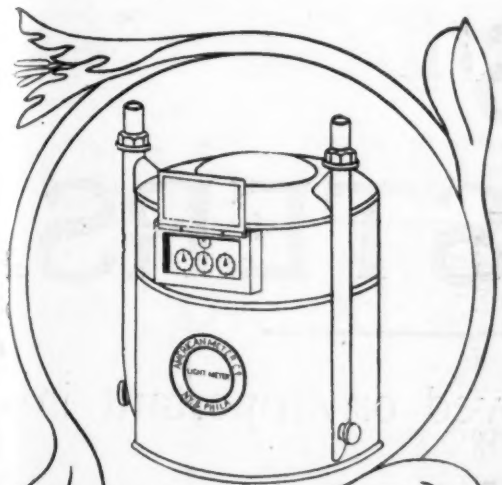

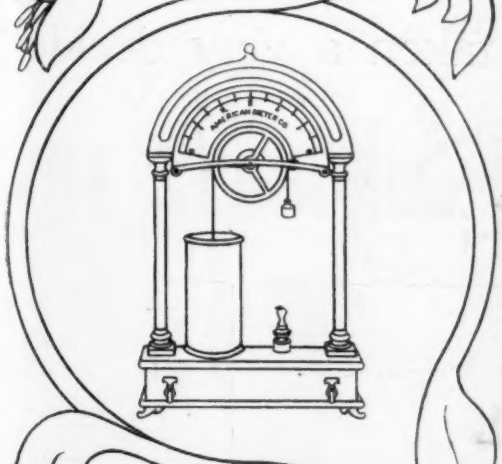

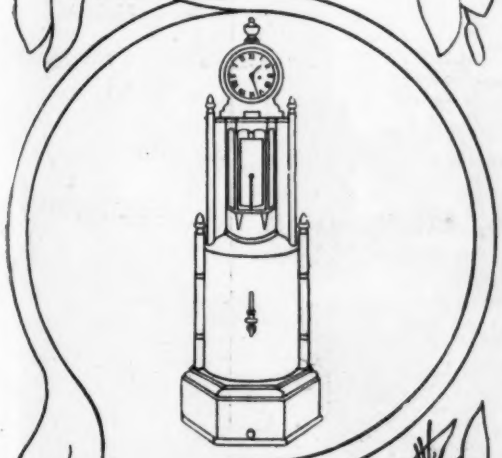

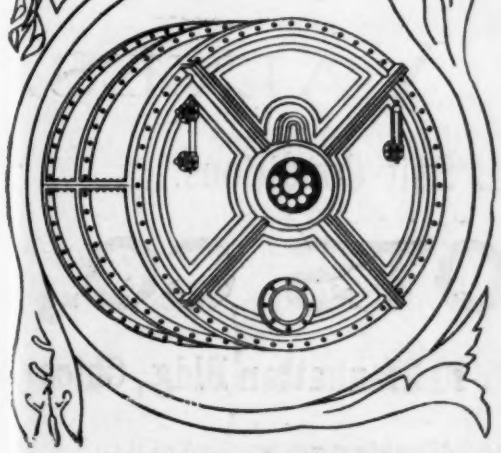

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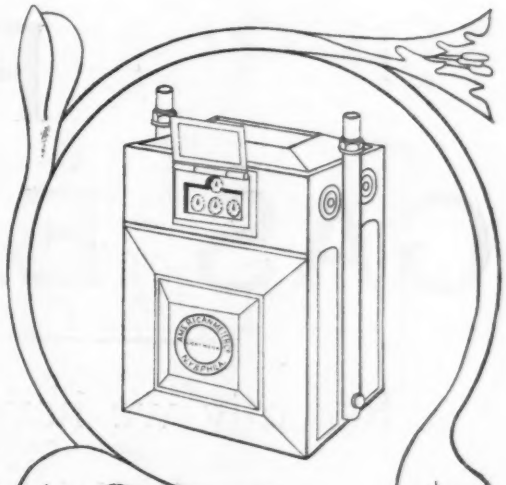
PUBLIC LIGHTING TABLE.

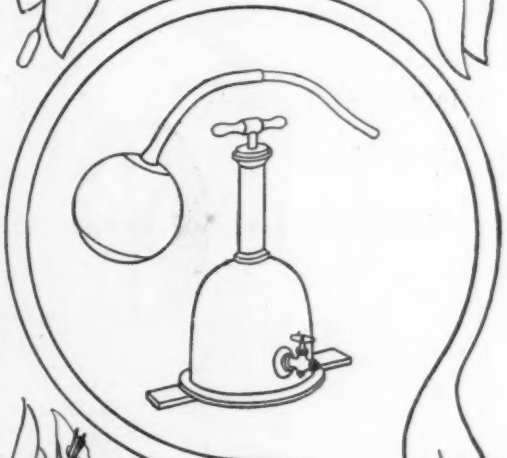
OCTOBER, 1894.

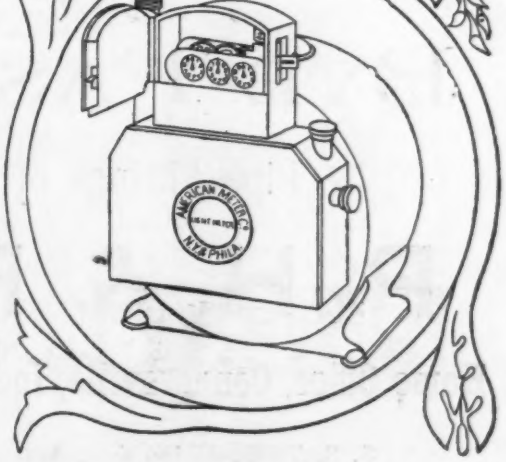
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Mon.	1	6.10 PM	5.00 AM	5.30	5.00
Tue.	2	6.10	5.00	5.30	5.00
Wed.	3	6.10	5.00	5.30	5.00
Thu.	4	7.40	5.00	5.30	5.00
Fri.	5	8.40	5.00	5.30	5.00
Sat.	6	9.30 FQ	5.00	5.30	5.00
Sun.	7	10.30	5.00	5.30	5.00
Mon.	8	11.40	5.00	5.20	5.10
Tue.	9	12.40 AM	5.00	5.20	5.10
Wed.	10	1.40	5.10	5.20	5.10
Thu.	11	2.50	5.10	5.20	5.10
Fri.	12	3.50	5.10	5.20	5.10
Sat.	13	No L.	No L.	5.20	5.10
Sun.	14	No L. FM	No L.	5.20	5.10
Mon.	15	No L.	No L.	5.10	5.20
Tue.	16	5.50 PM	7.10 PM	5.10	5.20
Wed.	17	5.50	7.50	5.10	5.20
Thu.	18	5.50	8.40	5.10	5.20
Fri.	19	5.40	9.40	5.10	5.20
Sat.	20	5.40	10.40	5.10	5.20
Sun.	21	5.40 LQ	12.00	5.10	5.20
Mon.	22	5.40	1.20 AM	5.00	5.30
Tue.	23	5.40	2.30	5.00	5.30
Wed.	24	5.40	3.40	5.00	5.30
Thu.	25	5.40	5 20	5.00	5.30
Fri.	26	5.30	5.20	5.00	5.30
Sat.	27	5.30	5.20	5.00	5.30
Sun.	28	5.30 NM	5.30	5.00	5.30
Mon.	29	5.30	5.30	4.45	5.35
Tue.	30	5.30	5.30	4.45	5.35
Wed.	31	5.30	5.30	4.45	5.35

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45







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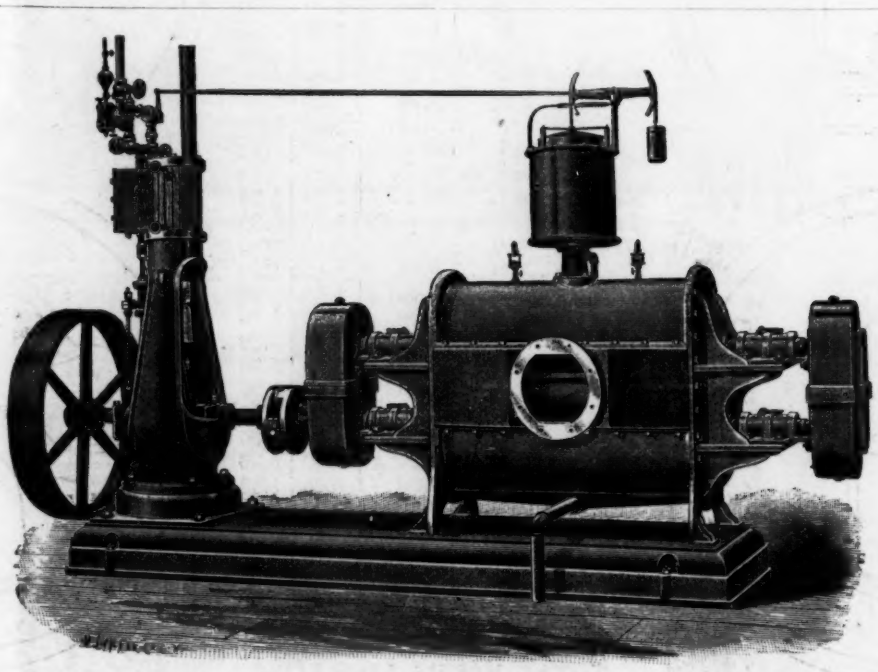

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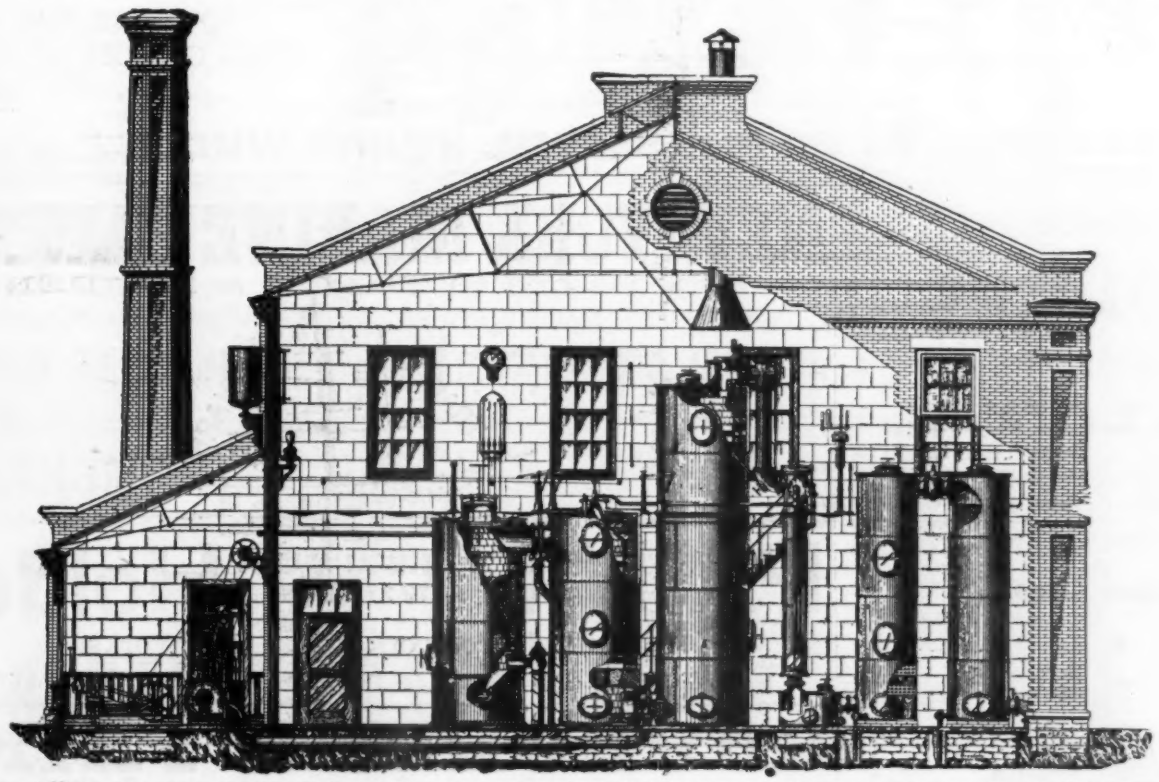

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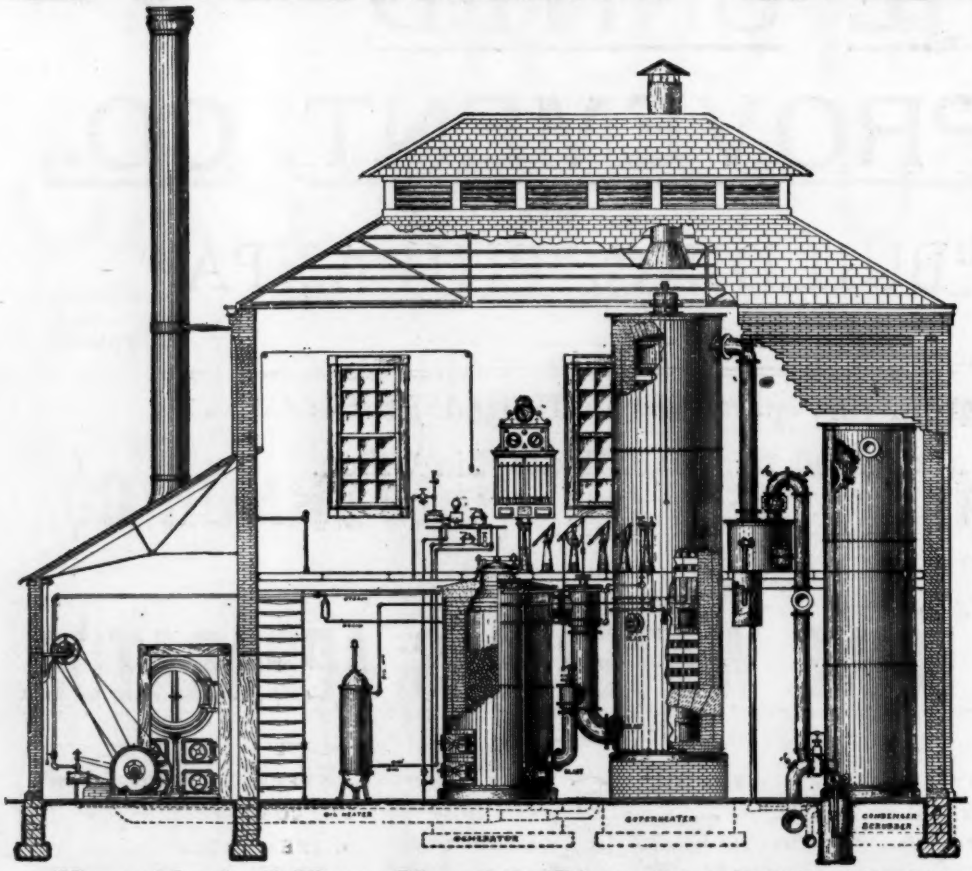

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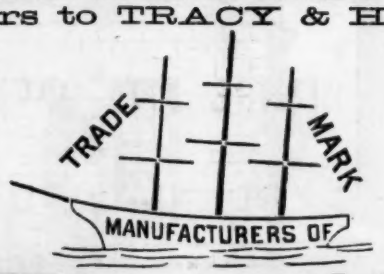

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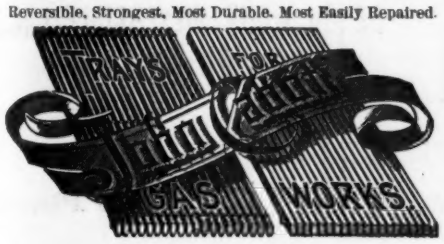

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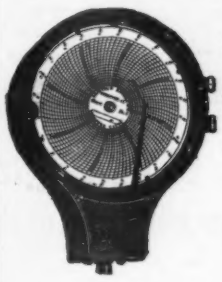

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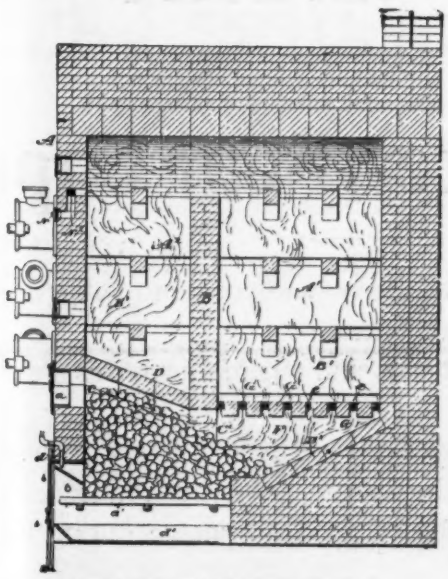

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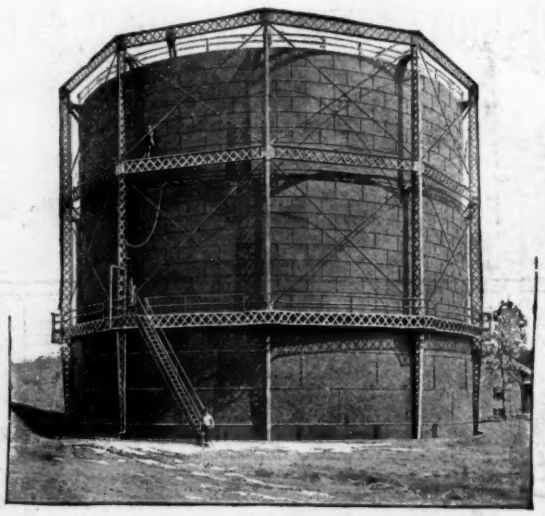

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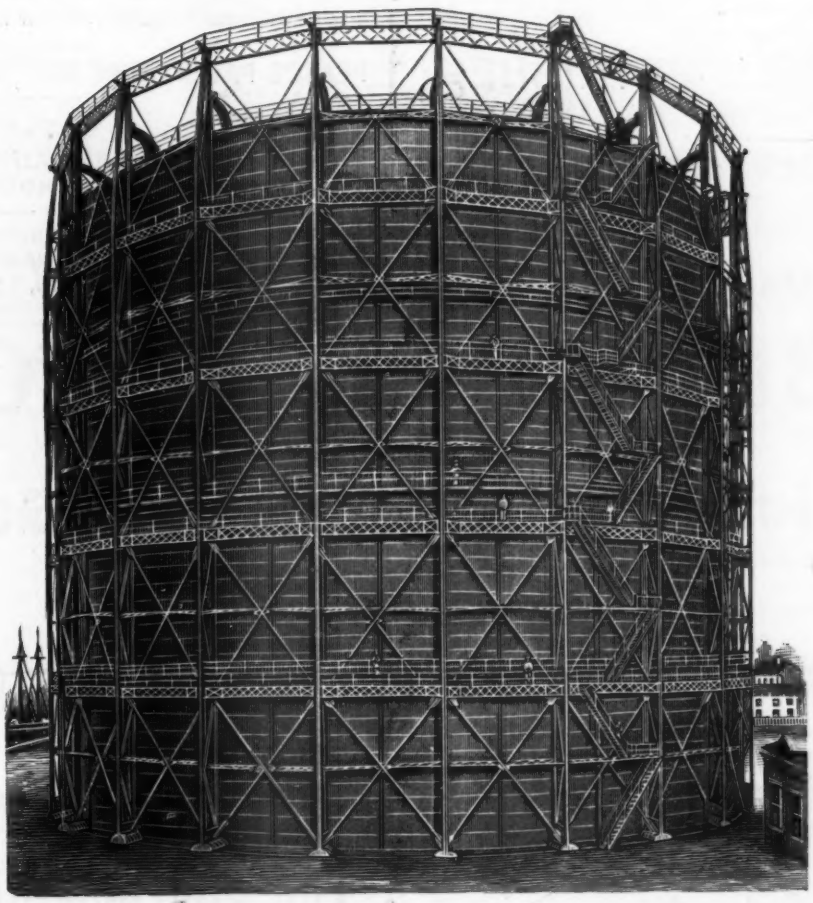

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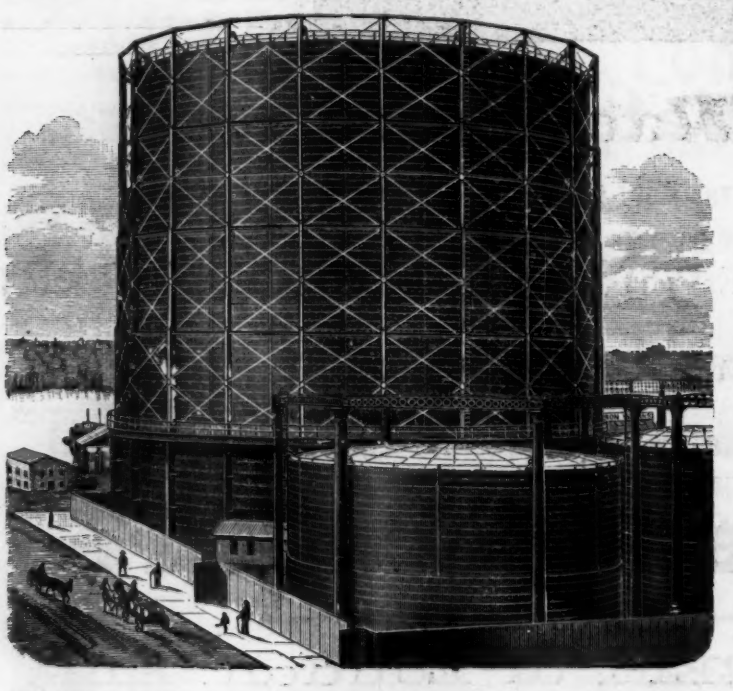

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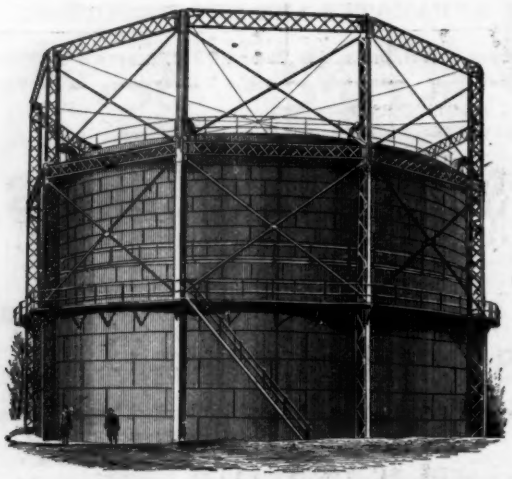
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.



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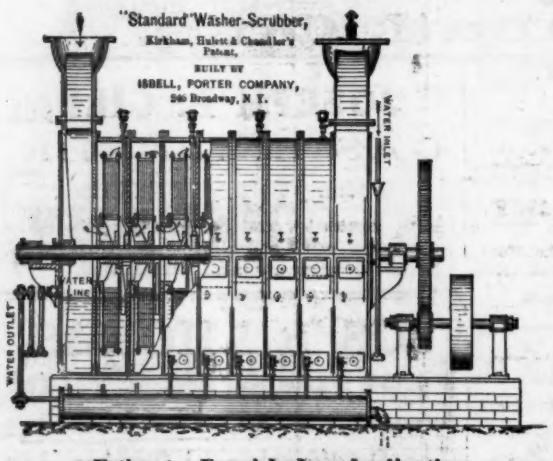


Estimates Furnished on Application.

"STANDARD" WASHER-SCRUBBER

The only apparatus that will remove ALL the ammonia and one-third of the Carbonic Acid and Sulphureted Hydrogen from Coal Gas.

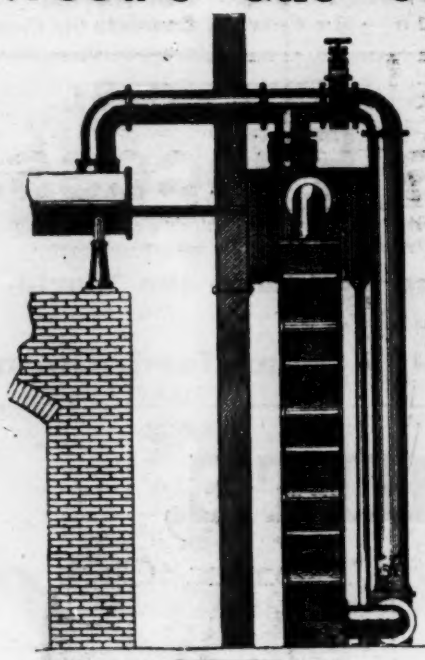
86

of these machines, capable of dealing with 75,082,000 cubic feet of gas daily, have been erected in the United States, and 456 in Great Britain. The "Standard" will save 25 per cent. to 35 per cent. on the investment through the sale of ammonia.

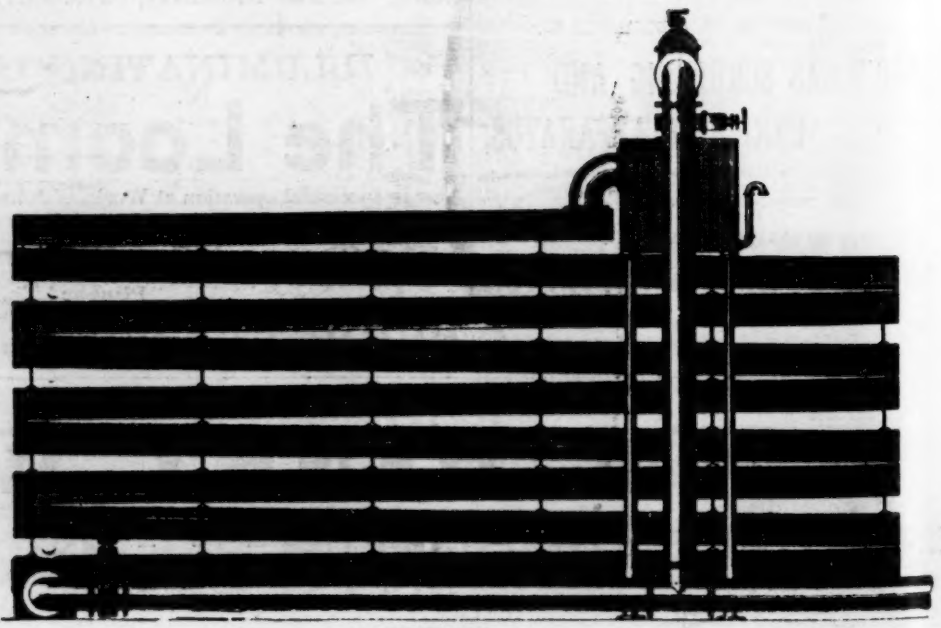
GEORGE SHEPARD PAGE'S SONS,

No. 69 Wall Street, - - - New York City.

Wood's Gas Scrubbing and Enriching Apparatus.



End Elevation.



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The cheapest, simplest, and most effective apparatus for removing Tar and Ammonia, and enriching Gas, ever brought to the attention of Gas Manufacturers. With ordinary condensers and scrubbers the condensable illuminants flow off to the tar wells and liquor tanks and are lost, but with Wood's Apparatus these illuminants are saved and retained in the gas, thus increasing its illuminating power and making a great saving in the cost of enriching material. Where set up next after the Hydraulic main, this Scrubber produces an 8-oz. Ammoniacal Liquor.

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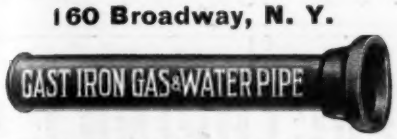

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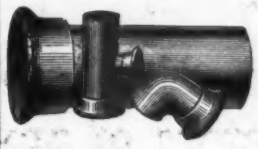

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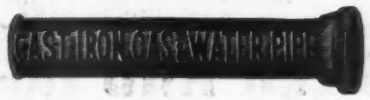

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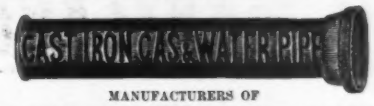

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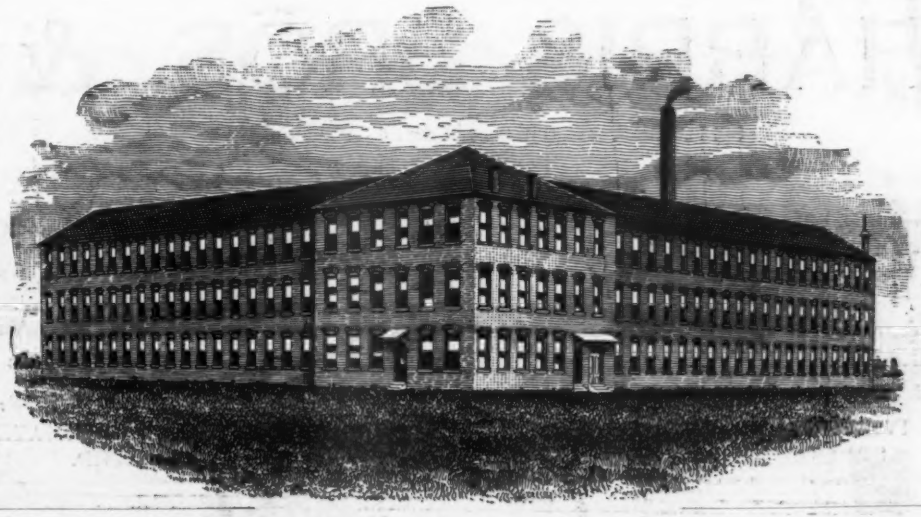

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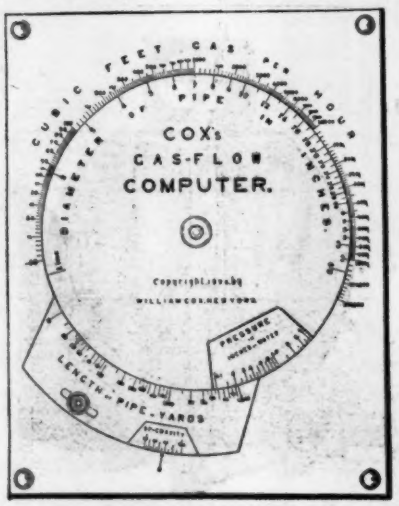

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3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.
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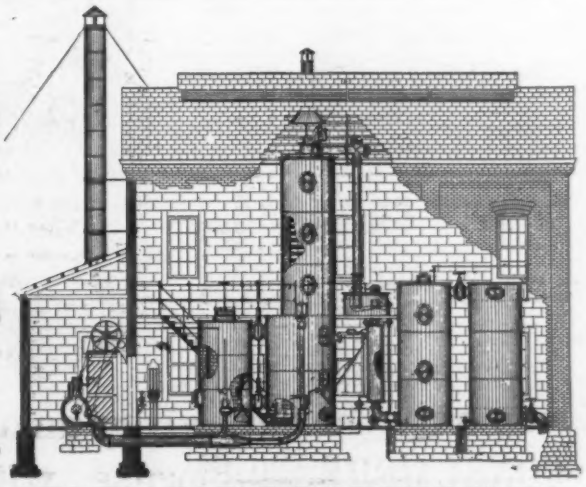

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